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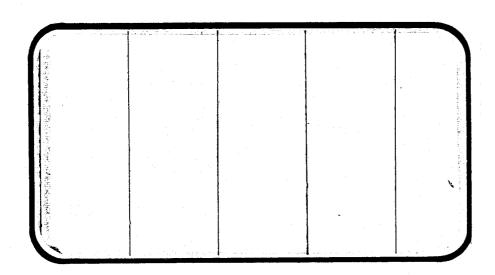
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

(NASA-CR-147646) HIGH SUPERSONIC STABILITY AND CONTROL CHARACTERISTICS OF A 0.015-SCALE (REMOTELY CONTROLLED ELEVON) MODEL 44-0 SPACE SHUTTLE ORBITER TESTED IN THE NASA/Larc 4-FOOT UPWT (LEG 2) (Chrysler G3/16 55772

N77-12109 HC A99 MF AOI Unclas



SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT



JOHNSON SPACE CENTER HOUSTON, TEXAS

DATA MANagement services SPACE DIVISION

DMS-DR-2318 NASA CR-147,646

VOLUME 1 OF 2

HIGH SUPERSONIC STABILITY AND CONTROL
CHARACTERISTICS OF A 0.015-SCALE (REMOTELY
CONTROLLED ELEVON) MODEL 44-0 SPACE SHUTTLE ORBITER
TESTED IN THE NASA/LaRC 4-FOOT UPWT (LEG 2)
(LA75)

Prepared under NASA Contract Number NAS9-13247

by

Data Management Services Chrysler Corporation Space Division New Orleans, La. 70189

for

Engineering Analysis Division

Johnson Space Center National Aeronautics Space Administration Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number:

LaRC No. 2 UPWT 1173

NASA Series Number: LA75

Model Number:

44-0

Test Dates:

6 through 16 April 1976

Occupancy Hours:

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HIGH SUPERSONIC STABILITY AND CONTROL CHARACTERISTICS OF A 0.015-SCALE (REMOTELY CONTROLLED ELEVON) MODEL 44-0 SPACE SHUTTLE ORBITER TESTED IN THE NASA/LaRC 4-FOOT UPWT (LEG 2)

(LA75)

ABSTRACT

The investigation was conducted in the NASA/Langley Research Center Unitary Plan Wind Tunnel Test Section 2 from April 6 to 16, 1976. The model was a Langley-built 0.015-scale SSV Orbiter model with remote independently operated left and right elevon surfaces. Special attention was directed to definition of nonlinear aerodynamic characteristics by taking data at small increments.

The objectives of the test were to obtain high supersonic aerodynamic data on control surface linearity and sensitivity to Mach number for finecut speed brake, body flap and rudder deflections, to investigate the interactive effects of mutual control surface deflections, and to obtain basic speed brake, body flap and rudder information not previously obtained in earlier studies.

Six component aerodynamic force and moment and elevon position data were recorded for the Space Shuttle Orbiter with various elevon, aileron rudder and speed brake deflection combinations over an angle of attack range from -4° to 32° at angles of sideslip of 0° and 3°. Additional tests were made over an angle of sideslip range from -6° to 8° at selected angles of attack. Test Mach numbers were 2.86, 2.90, 3.90 and 4.60 with Reynolds numbers held at a constant 2.0×10^6 per foot.

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- (N) ALPHA, RUDDER, AILRON, ELEVON
- (0) MACH, RUDDER, AILRON, ELEVON
- (P) MACH, BETA, RUDDER, ELEVON
- (Q) MACH, BDFLAP
- (R) MACH, ELEVON, BDFLAP
- (S) MACH, ELEVON
- (T) MACH, BETA, BDFLAP

NOMENCLATURE General

SYMBOL	MNEMONIC	DEFINITION
a		speed of sound; m/sec, ft/sec
$C_{\mathbf{p}}$	CP	pressure coefficient; $(p_l - p_{\infty})/q$
M	MACH	Mach number; V/a
р		pressure; N/m ² , psf
q	Q(NSM) Q(PSF)	dynamic pressure; 1/2 pV2, N/m2, psf
RN/L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
φ	PHI	angle of roll, degrees
ρ		mass density; kg/m^3 , $slugs/ft^3$
	Refe	rence & C.G. Definitions
Ab .		base area; m ² , ft ²
b	BREF	wing span or reference span; m, ft
c.g.		center of gravity
REF	LREF	reference length or wing mean aerodynamic chord; m, ft
S	SREF	wing area or reference area; m2, ft2
	MRP	moment reference point
	XMRP	moment reference point on X sxis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis
SUBSCRIPTS b 1 s t		base local static conditions total conditions
œ		free stream

NOMENCLATURE (Continued)

Body-Axis System

SYMBOL	MNEMONIC	DEFINITION
$\mathbf{c}^{\mathbf{N}}$	CN	normal-force coefficient; $\frac{\text{normal force}}{\text{qS}}$
CA	CA	axial-force coefficient; axial force
CY	CY	side-force coefficient; side force qS
$^{\mathrm{C}}_{\mathrm{A_{\mathrm{b}}}}$	CAB	base-force coefficient; base force
		$-A_b(p_b - p_{\infty})/qS$
$\mathtt{C}_{\mathtt{A_f}}$	CAF	forebody axial force coefficient, c_A - $c_{A_{\mbox{\scriptsize b}}}$
C _m	CLM	pitchin _f -moment coefficient; pitching moment qsl_{REF}
C _n	CYN	yawing-moment coefficient; Yawing moment qSb
cℓ	CBL	rolling-moment coefficient; rolling moment
		Stability-Axis System
$\mathbf{c}_{\mathbf{L}}$	CL	lift coefficient; $\frac{\text{lift}}{\text{qS}}$
c_D	CD	drag coefficient; drag qS
c_{D_b}	CDB	base-drag coefficient; base drag
$\mathtt{c}_{\mathtt{D_{f}}}$	CDF	forebody drag coefficient; C_D - C_{D_0}
$c_{\mathbf{Y}}$	CY	side-force coefficient; side force qS
C _m	CLM	pitching-moment coefficient; pitching moment ${}^{qS} \boldsymbol{\ell}_{REF}$
c _n	CLN	yawing-moment coefficient; yawing moment
C.L	CSL	rolling-moment coefficient; rolling moment qSb
L/D	L/D	lift-to-drag ratio; $C_{\rm I}/C_{\rm D}$
L/D L/D _f	L/DF	lift to forebody drag ratio; $c_{\rm L}/c_{\rm Df}$

NOMENCLATURE (Continued) Additions to Nomenclature)

SYMBOL	MNEMONIC	DEFINITION
δa	AILRON	aileron, total aileron deflection angle, degrees, (left aileron-right aileron)/2
^δ e	ELEVON	elevon, surface deflection angle, positive deflection trailing edge down, (left aileron + right aileron)/2
CA	CA	axial-force coefficient unadjusted for base or sting cavity pressures
CASC	CAC	sting cavity axial-force coefficient
ē _e		elevon mean aerodynamic chord, in.
Se		elevon planform area, ft.
δSB	SPDBRK	speed brake deflection angle, degrees
δ _r .	RUDDER	rudder deflection angle, degrees
δ _{BF}	BDFLAP	bodyflap deflection angle, degrees
X _{cp} / _L B	XCP/L	normal force center of pressure, percent reference length
δeL	ELVN-L	left elevon surface deflection angle, positive deflection trailing edge down, degrees
$^{\delta}$ e $_{R}$	ELVN-R	right elevon surface deflection angle, positive deflection trailing edge down, degrees
A _{sc}		sting cavity area, m ² , ft ²
L _B		body length, m, ft.
Δβ	DLTBTA	incremental angle of sideslip, difference between two or more test runs, degrees
	GRIT	<pre>parameter to denote testing with grit GRIT = 1 (grit on), GRIT = 0 (grit off)</pre>

INTRODUCTION

Langley Research Center (LaRC), assisting Johnson Space Center (JSC) in the Space Shuttle development program, is continuing their support in determining Space Shuttle Orbiter aerodynamics, utilizing, at present, an .015-scale model having remotely controlled elevons. The original phase of this project was initiated to determine, systematically, fine-cut stability and elevon/aileron control characteristics of the Orbiter and to locate areas of non-linear aerodynamics and to investigate the sensitivity of these non-linearities to Reynolds number in the Mach number range from 0.20 to 4.60.

During the analysis of results obtained in this basic program, several areas needing further investigation were discovered. No consideration was given to the possibility of interactive mutual interference effects between control surfaces in combination where one deflected surface could significantly affect the aerodynamic effectiveness of another. Also, there is a significant lack of data on the rudder effectiveness associated with incremental speed brake, or body flap deflections.

The objectives of these continuing studies are, therefore, to determine control effectiveness linearity for fine-cut speed brake, body flap, and rudder deflections and to investigate the interactive effects of mutual interference when control surfaces are deflected in combination.

The present investigation was initiated to study the high supersonic characteristics, utilizing the NASA/Langley Research Center Unitary Plan Wind Tunnel (Leg 2). The test was conducted from April 6 to 16, 1976.

INTRODUCTION (Concluded)

The test Mach numbers of this investigation were 2.86, 2.90, 3.90, and 4.60 with Reynolds number held at a constant 2.0×10^6 per foot. Six component aerodynamic force and moment and elevon position data were recorded for the Space Shuttle Orbiter with various elevon, aileron, rudder and speed brake deflection combinations over an angle of attack range from -4° to 32° at angles of sideslip of 0° and 3°. Additional tests were made over an angle of sideslip range from -6° to 8° at selected angles of attack.

MODEL DESCRIPTION

The test model was a 0.015-scale model of the Space Shuttle Orbiter (Figures 2 and 3). The model was constructed at the Langley Research Center using the nose section forward of full-scale fuselage station 672.8, the vertical tail and OMS pods from an existing Rockwell model 49-0. The remainder of the model, the wings, elevons, and body were constructed from Rockwell-furnished line details. The elevon hinge line gap was sealed for this test. The left and right elevon surfaces were driven independently by internally mounted electric motors. The elevon position was determined by high resolution potentiometers mounted on the pivot axis (hinge-line) of the elevons, thus giving the true position of the elevon under load at all times. The accuracy of the elevon position is the read-out accuracy of the potentiometer, which was determined to be within 0.2 degree.

The model configuration is summarized as follows:

Orbiter - 140A/B/C = $B_{26} C_9 E_{43} F_8 M_{16} N_{28} R_5 V_8 W$

	20 3 43 0 10 20 3 0
Component	<u>Definition</u>
B ₂₆	Fuselage per Rockwell Lines VL70-000140A and VL70-000140B (Model drawing SS-A00147)
c ₉	Canopy per Rockwell Lines VL70-000143A and VL70-000143B (Model drawing SS-A00147)
E ₄₃	Slotted version (6-inch) of E ₂₆ elevons per Rockwell VL70-000145 (Model drawing SS-A00147)
F ₈	Body flap per Rockwell Lines VL70-000145 (Model drawing SS-A00147)
^M 16	OMS/RCS pods per Rockwell Lines VL70-0084010 (Model drawing SS-A00147)
N ₂₈	OMS engine nozzle per Rockwell Lines VL70-000145 (Model drawing SS-A00147)

MODEL DESCRIPTION (Concluded)

Component	<u>Definition</u>
R ₅	Rudder per Rockwell Lines VL70-000146A (Model drawing SS-A00148)
v ₈	Vertical tail per Rockwell Lines VL70-000146A (Model drawing SS-A00148)
W	Wing per Rockwell V70-30-906-01 (Basic Control drawing)
A complet	re description of model dimensional data is given in Table III

TEST CONDITIONS

The tunnel conditions existing during the test are summarized in Table I and the configurations tested are shown in Table II. The model was sting supported, and the aerodynamic forces and moments were measured by an internally mounted six-component strain gage balance. In an attempt to insure turbulent flow over the model, strips of carborundum grit were applied to the wing, vertical tail, and nose as shown in Figure 2. Model angle of attack was varied from about -4 to 32° for angles of sideslip of 0° and 3° . Sideslip angles were varied from -6° to 8° at angles of attack of 6° , 12° , 20° , and 30° . Angles of attack and sideslip have been corrected for the effects of sting deflection under load. Runs were made either by setting the elevons at a fixed angle from $+10^{\circ}$ to -10° or by varying the elevon angle at a given angle of attack and sideslip. No additional correction due to load has been applied to elevon angle since total torsional bending of the elevon has been determined to be negligible.

TEST FACILITY DESCRIPTION

The NASA LaRC 4 foot Unitary Plan Wind Tunnel (UPWT) is a closed-circuit continuous flow, variable density facility. The test section is 4 feet by 4 feet by 7 feet long.

Two tunnel legs are available for supersonic testing in the Mach number ranges 1.47 to 2.86 (Leg No. 1) and 2.29 to 4.63 (Leg No. 2). Leg No. 2 was used for this test. An asymmetric, sliding block nozzle position and total pressure setting provide the test Mach numbers at a specified Reynolds number. Reynolds number can be varied from 0.76 to 7.78 million per foot. Available stagnation pressure variation is 4.0 to 142 psia. Dynamic pressure variation is 95 to 1260 psf with normal operating stagnation temperature about 150°F in Mach modes 2 or 3 and about 175°F in Mach mode 4. The tunnel is equipped with a dry air supply, an evacuating system, and a cooling system. The facility power is approximately 83,000 horsepower.

Model mounting provisions consist of various sting arrangements, including axial (longitudinal), lateral (independent pitch and yaw), and roll movement with side wall support. A Schlieren system and oil flow visualization equipment are available. Data are recorded at the tunnel and reduced off-line at the Langley Computer Center. The tunnel is used for force and moment, pressure, and dynamic stability tests. Hot and cold jet effects and heat transfer have been studied in the UPWT.

DATA REDUCTION

LaRC UT-27-100 six-component strain gage balance was used to measure model forces and moments. All final data were presented along a set of body and stability axes (Figure 1) through the nominal center of gravity located at F.S. 1076.7 and FRL 375.0. Drag data presented represent gross drag in that no corrections to free-stream conditions in the base regions have been made. Model data were converted to standard NASA coefficients using the following constants:

Reference Area	S _{ref} = 0.605 ft. ²
Reference Length	$\ell_{ref} = 7.122 in.$
Reference Span	b _{ref} = 14.05 in.
Total base area excluding sting cavity	$A_b = 0.0615 \text{ ft.}^2$
Sting cavity area	$A_{sc} = 0.03409 \text{ ft.}^2$

ST : Larc UPWT 1	L73 (LA75)		DATE : 6/10/76
	TEST CON	NDITIONS	
MACH NUMBER	REYNOLDS NUMBER (per foot)	DYNAMIC PRESSURE (pounds/sq. inch)	STAGNATION TEMPERATUR (degrees Fahrenheit)
2.86	2.0 x 10 ⁶	2.74	175
2.90	2.0 x 10 ⁶	2.72	175
3.90	2.0 x 10 ⁶	2.08	175
4.60	2.0 x 10 ⁶	1.63	175
BALANCE UTILIZED:	UT-27-100		
	CAPACITY:	ACCURACY:	COEFFICIENT TOLERANCE:
NF	600 lb.	± 3.0 lb.	
\$ F	300 lb.	±1.5 lb.	
AF	100 lb.	±0.5 1b.	
PM	800 in. 1b.	±4.0 in. 1b.	
RM	400 in. 1b.	±2.0 in. 1b.	
YM	600 in. 1b.	±3.0 in. 1b.	<u> </u>
COMMENTS:			

TABLE II

DATASE		CURATION	sc	HD.					PARAM	ETE	RS/VALU	JES			·	1	ACH N	IUMBER	S
IDENTIFI	ER		α	β	δe	δα	δ	$SB \delta r$	$\delta_{ m BF}$						2	2.86	2.90	3.90	4.60
RJH00	1	Orb	A	0	0	o	2	5 0	0							1			
0	2			3	1											6			
0	3			0	-10											2			
0	4			3	l i	. •										5			
0	5			0		5	\prod									3			
0	6			3		•										4			
0	7		П	0	0	. 0		-10								278			
0	8			0	-10	1										279			
0	9			0		5							1.			280			
ı	0			3			1									281			
1				0	0	0	39.	7 0						1		102		108	115
1	2		11	3			ÏĨ											112	
1	3		11	0	-10		1-1						1	1		103		109	116
1			1+	0		5	1 1					· · · · · ·	 	-		104		110	117
1	5		#	3		Ī	11	_					+			105		111	118
1	5		11	0	0	0	††	-10			1		1	 	-	121		127	133
 1	7	V	† † -	0	1	J	1-1					-				122		128	134
CN	, CA	CLM CL	<u></u>	10	<u>-10</u> CD		, L/	D	, CAB	<u> </u>	CBL	<u> </u>	CYN	CY	, M	IACH	, F	LPHA	, 1
BETA	, ELEVON ,	AILRON EL	VN-L		ELVN	-R	, CA	ıC	, Q(PS	F)	<u>.</u>				, M	ACH	, F	LPHA	1
						-	1		1		·	1		1	<u> </u>				1

	TA SET		1173 (- -	HD.								/VAL		(MARY		4/23	MACH N	NUMBER	S	
	TIFIER		GURATIO	УИ	α	β	δe	δα	δ_{SB}	$\delta_{\mathbf{r}}$		معه بجالمونث						2.86	2.90	3.90	4.60	Ĭ
RJ	8101		Orb		A	٥	-10	5		-10	9							123_		129	135	
	19					3				-10								124		130	136	
	50			·	Ц	0			52.7	0								 248		257	268	
	21				Ш	3	1	1		0								 252		258	269	1
	22		<u> </u>	· ,	Ш	0	0	0		-275		_						 174		178	182	1
	23	<u> </u>					-10											175		179	183	_
	24				Ш	1		5										176		180	184	
	25					3				•		-					<u> </u>	 177	<u> </u>	181	185	
-	26			-		0	0	0		-5.6								186		190	194	
	27						-10_							•				187		191	195	
	28				П			5	\prod									188		192	196	
	29					3												189		193	197	
	30				П	0	0	0	11	-10								15		32	48	
	31				\prod	3									•			22		39	55	-
	32					0	-10											16	31	33	49	
	33				П	3												21		38	54	
	34		1		T	0		5										17		34	50	
CN		CA ,	CLM	CL	****	د خده ا	CD	ستسد ا	L/D		, CA	В	1	CBL	1	CYN	CY	MACH	/	ALPHA	1	0
BET	A 1	ELEVON	AILRON	l EL	VN-L	1	ELVN	-R	CAC		, Q(PSF)) i					MACH	1	ALPHA		7
ſYPĒ	OF DAT		A:	−jt < α	. <	_ 32			J	OEFFI	CIEN	IT SC	HEDU	LES				וסט	AR (1)	10VA	1 R (2)	14

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	TA SET		1173 (LA			HD.	DATA	4 3 =	1/80	יטא א	MBER C	.			MART	l		4/23/7	NUMBER	ς
	TIFIER	CONF	GURATION		a	β	δe	δa	δSB	δr	δBF	ILN	VAVEC		7	T			3.90	
RJ	тно35		Orb		Α		-10	5		-10					+	1	20		36	
***************************************	T 36	-			T	0	0	0		16.9						11	198	1	505	206
	37				1		-10		 						<u> </u>		199	· 	203	207
	38							5							1	1	500		204	208
	39					3											201	Ì	205	209
	40					0	0	0		23.3							210		214	218
	41						-10	•									211		215	219
	42							-5			1						212		216	220
	43					2											213	1	217	221
	44					0	10	0		0	22.5			-			244			245
	45						0										242			247
	46						-10										243			246
	47						10				16.3						224			229
	48							5						•	Ì		225			230
	49					3	•	•			,						226			231
	50					0	0	0									555			227
	51		\			+	-10	1		•	1				<u> </u>		223			228
CN		CA	CLM	CL			CD		L/D		CAB		CBL	10	YN	CY	MACH	/	ALPHA	110
BET	Α 1	ELEVON ,	AILRON	ELV	N-L		ELVN	-R	CAC		Q(PSF)					MACH	1	ALPHA	
YPE	OF DATA		A: -1	. < α.	< :	32				OEFFIC	LIENT SC	HEDU	LES				IDV	'AR (1)	IDVAR	(2)

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TABLE II (Continued) DATE: 4/23/76 TEST: Larc UPWT 2 1173 (LA75) DATA SET/RUN NUMBER COLLATION SUMMARY MACH NUMBERS PARAMETERS/VALUES DATA SET SCHD. CONFIGURATION IDENTIFIER $\delta_{e} \mid \delta_{a} \mid \delta_{SB} \mid \delta_{r} \mid \delta_{BF}$ αβ 2.86 2.90 3.90 4.60 RJH052 0 52.7 236 Orb 10 237 0 232 238 53 -10 54 233 239 ·5 240 55 234 56 241 235 57 944 | 150 70 139 0 58 145 | 152 140 -10 141 146 | 153 59 60 147 142 154 61 168 156 162 62 158 164 -10 169 63 170 159 165 160 166 64 171 66 72 78 65 67 73 79 66 68 74 80 67 69 81 75 68 CY MACH **ALPHA** 10 CYN L/D CAB CLM CL CD CBL CN CA R: MACH **ALPHA** S: **ELEVON** AILRON ELVN-L ELVN-R CAC Q(PSF) **BETA** COEFFICIENT SCHEDULES IDVAR (1) ICVAR (2) NOV TYPE OF DATA A: $-4 < \alpha < 32$ a OR B SCHEDULES

	TASET	1 (10)	IGURATI	ON		HD.]		-		THE R. P. LEWIS CO., LANSING		RS/V	LUE	S				MACH N	,		-بر
بمصن	TIFIER	-			α	β	δ_{e}	$\delta_{\mathbf{a}}$	$\delta_{\rm SI}$	δ_{r}	$\delta_{\rm B}$				-		ļ	 2.86	2.90	3.90	4.60	Ì
RJ.	1069		Orb		A	0	0	Q	82.5	-10	0		_			ļ		 84		90	96	
	70					Ш	-10	1									<u></u>	 85		91	97	
	71					1		5								<u> </u>	<u> </u>	86		92	98	
	72		<u> </u>		1	3.				1								87		93	99	
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N		CA	CLM	, CL	_	<u>.                                    </u>	CD		L/D	<u> </u>	CAE	<u></u>	CBL		. C	YN	, CY	MACH	<u>.                                    </u>	LPHA	, 10	<u>.</u>
BET		ELEVON	, AILRO		/N_I		ELVN	_R	CAC		, Q(F		1 3					 MACH		LPHA	<del></del>	7
	<u>'</u> -	CELTON	17.122.10		- 1 - 1	1	VIV			<del>,</del>	1 4/1	<del></del>	<u> </u>					 				_
 (PE	OF DAT	4	<del></del>	4 < α	- <del></del>				· · ·	OEFFI	CIENT	SCHI	DULES		L		- <b></b>	 IDV	AR (1)	IDVAF	R (2) N	4 (

DATA SET	CONFIGURATION	SC	HD.					PARAM	ETER	RS/VAL	UES			· )	MACH NU	JMBER	S
DENTIFIER	CONTROLL	α	β	δe	δа	$\delta_{\mathrm{SB}}$	$\delta_{\mathtt{r}}$	$\delta_{\mathrm{BF}}$						2.86	2.90	3.90	4.60
RJH073	Orb	6	В	9	0	25	Q	0						7			
74		12												8			
75		20					٧							9			
76		20					-10							283			
77		30		1			0					7		10			
7.8	•	6		-10	5									14			
79		. 12			H									. 13			
80		20							-					12			
81		20				1	-10					1.		282			
82		30			1	1	0							11			
83		20		0	0	39.7								107		112	120
84				-10	5	T				1	1			106		114	1
85				0		1-	-10					T		126			138
86				-10							1			125		131	
87		6		0	1	52.7	0	<b></b>		1	<del> </del>	<del> </del>	1			_=	274
88		12		1 Ť	ΙŤ	1)21				<del> </del>	<del> </del>	<del>                                     </del>	1				.275
89		20	-	1-		1-1-				1		-				A	276
CN C	A CLM C	اسمسام	_	CD		, L/D	<del>  </del>	CAB		. CBL	, C	NY:	, CY	MACH	BE	TA	, 10
	EVON , AILRON , E						·	Q(PS	F)				<del></del>	MACH	BE	TA	1
<u>,                                    </u>	1 1					<u> </u>		· · · · · · · · · · · · · · · · · · ·		<u></u>	<u>-</u>		<del></del>	<del></del>	······································		i
YPE OF DATA	В: -6 < в	. 0	•			c	OEFFIC	IENT S	SCHEE	ULES		•		IDV	AR (1)	IDVAF	२ (२)

DATA SET	CONFIGURATION	SC	HD.				•	PARA	METE	RS/VAL	JES				MACH N	UMBER	S
DENTIFIER	CONFIGURATION	α	β	δe	δа	$\delta_{SI}$	$\delta_{r}$	$\delta_{BF}$						2.86	2.90	3.90	4.60
RJH090	Orb	20	В	<u>                                     </u>	0	52.	0	0						254		263	276
091		30			1												277
092		6		-10	5		LL							549		259	270
093		12												250		260	271
094		50												251		261	272
095		30			V		1							253		262	273
096		. 6		Q	0		-10							23		40_	<b>5</b> 6
097		12												24		41	57
098		20												25		42	58
099		30		+	<b>V</b>							-		26		43	59
100		6		-10	5									30		47	63
101		12												29		46	62
102		20												28		45	61
103		30			¥									27		44	60
104		20		0	0	70	0							144		149	151
105				-10	5_		İ							143		148	155
106	<b>\</b>	ų į	i i	0_	0	•	-10						<u> </u>	173		157	163
CN CF	CLM C	L	. 1	CD		, L/D		CAB		CBL	Τ.	YN	CY	MACH		ETA	1
ALPHA EL	EVON ; AILRON ; E	LVN-L		ELVN	-R	CAC		, Q(PS	SF)	<u>.</u>			<u> </u>	MACH	В	ETA	
						<u> </u>		CIENT		<u>.                                    </u>					AR (1)		<u> </u>

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			_1173 (I				DAT	V SE.	T/RU	N NU	MBE	ER	COL	LATIO	n sum	IMARY		DATE	:	4/23/7	6		
	TA SET	CONF	IGURATIO	N	SC	нD.					المساحلة المالية	_	ETER	S/VAL	UES					MACH I	NUMBER	S	
IDE	NTIFIER		CONCRETE STATE OF THE STATE OF		α	β	δe	$\delta_{\mathbf{a}}$	$\delta_{SB}$	$\delta_r$	$\delta_{\rm B}$	F							2.86	2.90	3.90	4.60	1
R	JH107		Orb		<u> 20</u>	В	-10	5	70	-10	0								172		161	167	
	108	· · · · · · · · · · · · · · · · · · ·					0	0	82.5	0									70		76	83	
	109	+ 1					-10	5											71		77	82	
	110						0	Ö		-10									89		94	101	
,	111			:		•	-10	5											88		95	100	1
		•										-1		1	1				1				
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				<del></del>					-					<del> </del>	<del> </del> -	<del>                                     </del>	1	<del> </del>	<del> </del>			<del> </del>	200
		<del></del>							<del> </del>			-	<del></del>		<del> </del>		<del> </del>	<del> </del>	<del>                                     </del>	<del></del>	<del> </del>		3
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		~	0.14				CD		1 /2		, CA			CBL	<u> </u>	CYN	CY		MACH		BETA	<u> </u>	
CN		CA	CLM	CL			CD		L/D					CDL		CIN	-101				BETA	<u> </u>	7
ALF	PHA	ELEVON	1 AILRON	; EL\	/N-L		LLVN	<u>-K</u>	CAC		; Q(	<u> 1751</u>	-)	<u> </u>			i	نـــــــــــــــــــــــــــــــــــــ	MACH		DEIA		4
TYPE	OF DATA	β	В: -	-6 < β	< (	8			C	OEFFI	CIEN	T S	CHED	ULÉS					IDV.	AR (1)	AVOI	R (2) 1	10v
	SCHEDU	_ES			-														-		مرون مرفت فدانسيم		

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TABLE II (Concluded)

DATA SET	CONFIGURATION	sc	HD.					PARAM	ETER	S/VALU	IES			•		MACH N			<del></del>
IDENTIFIER	CONTIGURATION	a	β	δe	δα	δsb	δr	$\delta_{\mathrm{BF}}$							2.86	5.90	3.90	4.60	ĺ
RJH112	0rb	20	0	10	D	52.7	-10	O_							18				
113			3	<b>V</b>			•			<u> </u>					19				
114			٥	-10			0								255		264	266	
115			3												256		265	267	l
116			0				-10								64		35_	_51_	
117			3	V			<b>V</b>								65		37	52	
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CN	CA : CLM ,	<u></u> CL	ــــــ	CD	<u> </u>	<u>:</u> L/	<u>г</u>	, CAB	<del></del>	CBL	<u> </u>	CYN	CY	<u> </u>	, MACH	<u> </u>	AILRO	N , 10	0
CN I	CA : CLM , ELVN-L ; ELVN-R ,			Q(P	SE)		PHA	BET					1		MACH	[	AILRO	N	_ 7
ELEVUN 1	ELAN-L   FLAN-K	CAC		411	<u> </u>	<u>, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>		1			<u>-</u>				l	1			_
TYPE OF DATA	D: $-5 < \delta_a$	< 5	1			<del>-1</del>	OEFFI	CIENT	SCHED	ULES					IDV	AR (1)	IDVA	R (2) N	4 0

# TABLE III. MODEL DIMENSIONAL DATA

MODEL COMPONENT : BODY B26		
GENERAL DESCRIPTION: Configuration	40A/B Orbiter	Fuse lage
NOTE: B26 is identical to B24 except ur	nderside of fus	elage has been
refaired to accept W		
MODEL SCALE: 0.015 MODEL DRA	WING: SS-A001	47, RELEASE 12
DRAWING NUMBER: VL70-000143B, -000200	0, 000205, -0 0140B	06089,
DIMENSIONS:	FULL SCALE	MODEL SCALE
* Length (OML: Fwd Sta. X _o =235)-In.	1293.3	19.400
* Length(IML: Fwd Sta. $X_0$ =238)-In. * Max Width (@ $X = 1528.3$ ) - In.	1290.3 264.0	19.355 3.960
Max Depth (@ X _O = 1464) - In.	250.0	3.750
Fineness Ratio	· · · · · · · · · · · · · · · · · · ·	
Area – Ft ²		
Max. Cross-Sectional	340.88	0.077
Planform		
Wetted .		
Base	•	•

# TABLE III—Continued MODEL DIMENSIONAL DATA

MODEL COMPONENT : CANOPY	/ - C ₉	•	
GENERAL DESCRIPTION :Cor	figuration 3A,	Canopy used	with Fuselage
B26		······································	
:		:	
MODEL SCALE: 0.015	MODEL DRAWING:	SS-A00147	, RELEASE 12
DRAWING NUMBER:	VL70-000143A/B		
DIMENSIONS :	F	ULL SCALE	MODEL SCALE
Length (X ₀ = 434.643	to 587)	143.357	2.150
Max Width (@ X ₀ = 51)	3.127)	152.412	2.286
Max Depth (@ X _O = 48	35.0)	25.000	0.375
Fineness Ratio			
Area	•		
Max. Cross—Sect	ional		
Planform			
Wetted	erio. No servicio		
Base	بيغ	:	•

# TABLE III-Continued MODEL DIMENSIONAL DATA

MODEL COMPONENT : SLOTTED ELEVON (6-	inch GAP) - E43	}
GENERAL DESCRIPTION Configuration 140A	/B Orbiter elev	on.
NOTE: E43 is a slotted version of E ₂₆ .	Data are for o	one side.
MODEL SCALE: 0.015 MODEL DRAWIN	G: SS-A00147	
DRAWING NUMBER VL70-000-000145		
DIMENSIONS	FULL SCALE	MODEL SCALE
Area - Ft ²	210.0	0.0473
Span (equivalent) - In.	349.2	5.238
Inb'd equivalent chord - In.	118.004	1.770
Outb'd equivalent chord/ total surface chord Ratio movable surface chord/ total surface chord	55.192	0.828
At Inb'd equiv. chord	0.2096	0.2096
At Outb'd equiv. chord	0.4004	0.4004
Sweep Back Angles, degrees		
Leading Edge	0.00	0.00
Trailing Edge	-10.056	-10.056
Hingeline	0.00	0.00
Area Moment (Normal to hinge line)	1587.25	0.00536
Mean Aerodynamic Chord (c), in.	90.7	1.3605

### TABLE III-Continued MODEL DIMENSIONAL DATA

MODEL COMPONENT : BODY FLAP -F8	······································	
GENERAL DESCRIPTION : Configuration	140A/B Orbiter	Body Flap.
Hingeline loca	ated at $X_0 = 152$	$28.3, Z_0 = 284.3$
MODEL SCALE: 0.015 MODEL DRAWING	. SS-A00147, RI	ELEASE 12
DRAWING NUMBER: VL-000140A,	<b>V</b> L70-000145	
DIMENSIONS :	FULL SCALE	MODEL SCALE
Length $(X_0 = 1520 \text{ To } X_0 = 1613)$	93.000	1.395
Max Width (In.)	262.00	3.930
Max Depth $(X_0 = 1520)$ - In.	23.000	0.345
Fineness Ratio		
Area - Ft ²		
Max. Cross-Sectional		
Planform	150.525	0.0339
en de la companya de <b>Wetted</b> de la granda de la companya de la companya de la companya de la companya de la comp	<del></del>	
Base	41.84722	0.00941

# TABLE III—Continued MODEL DIMENSIONAL DATA

MODEL COMPONENT : OMS	Pod (M ₁₆ )			
GENERAL DESCRIPTION :	Configuration	140D (	Orbiter O	1S Pod
			<b>)</b>	
MODEL SCALE: 0.015	MODEL DRAWING	NO:	SS-A0014	7
DRAWING NUMBER:	VI.70-000140D VL70-0084010			
DIMENSIONS:		FULL	SCALE	MODEL SCALE
Length (OMS Fwd Sta	x _o =1310.5) <u>-</u> I	n <u>2</u>	58.5	3.878
Max Width (@ X _O =	1511) - In.	1	36.8	2.052
Max Depth (@ X _o =	1511) - In.	<del></del>	74.7	1,121
Fineness Ratio			2.484	2.484
Area - Ft. ²	•		· · · · · · · · · · · · · · · · · · ·	****
Max. Cross—Se	ectional	*******	58.864	0.0132
Planform				· · · · · · · · · · · · · · · · · · ·
Wetted		· · · · · · · · · · · · · · · · · · ·		
Base			• ;	•

### TABLE III - MODEL DIMENSIONAL DATA-Continued

MODEL COMPONENT: OMS NOZZLES - N28		
GENERAL DESCRIPTION: Configuration 140A/B Orbiter OMS Nozzles		
MODEL SCALE: 0.015 - MODEL DRAWING:	SS-000147 RELEASE 5 (C	Contour)
DRAWING NUMBER: VL70-000145, (location)		
DIMENSIONS:	FULL SCALE	MODEL SCALE
MACH NUMBER		
Length- In.	•	
Gimbal Point to Exit Plane Throat to Exit Plane		
Diameter - In. Exit Throat Inlet		
Area - ft ² Exit Throat		
Gimbal Point (Station) - In. Left Nozzle	1510.0	00.770
Xo	1518.0 -88.0	22.770
··· Y _o Zo	490.2	7.380
Right Nozzle	1510 0	00 770
	1518.0 +88.0	22.770 +1.320
<b>Y</b>	492.0	7.380
Null Position - Deg. Left Nozzle	15 ⁰ 49'	15 ⁰ 491
Pitch Yaw	12017	12017
Right Nozzle Pitch Yaw	15 ⁰ 49'	15 ⁰ / ₁₉ 1

## TABLE III—Continued MODEL DIMENSIONAL DATA

MODEL COMPONENT RUDDER - R5	•	
GENERAL DESCRIPTION 2A, 3, 3A	, and 140A/B Con	figurations
MODEL SCALE: 0.015 MOD	DEL DRAWING: SS-	A00148
DRAWING NUMBER VL70-000146A, VL70-0	000095, V170-0001	39
DIMENSIONS	FULL SCALE	MODEL SCALE
*Area Ft ²	100.15	0.0225
Span (equivalent) - In.	201.0	3.015
Inb'd equivalent chord - In.	91.585	1.3738
Outb'd equivalent chord - In.	50.833	0.7625
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	0.400	0.400
At Outb'd equiv. chord	0.400	0.400
Sweep Back Angles, degrees		
Leading Edge	34.83	34.83
Trailing Edge	26.25	26.25
Hingeline	34.83	34.83
Area Moment (Normal to hinge line)	610.92	0.002
Mean Aerodynamic Chord, - In.	73.2	1.098

# TABLE III (Continued) MODEL DIMENSIONAL DATA - Continued

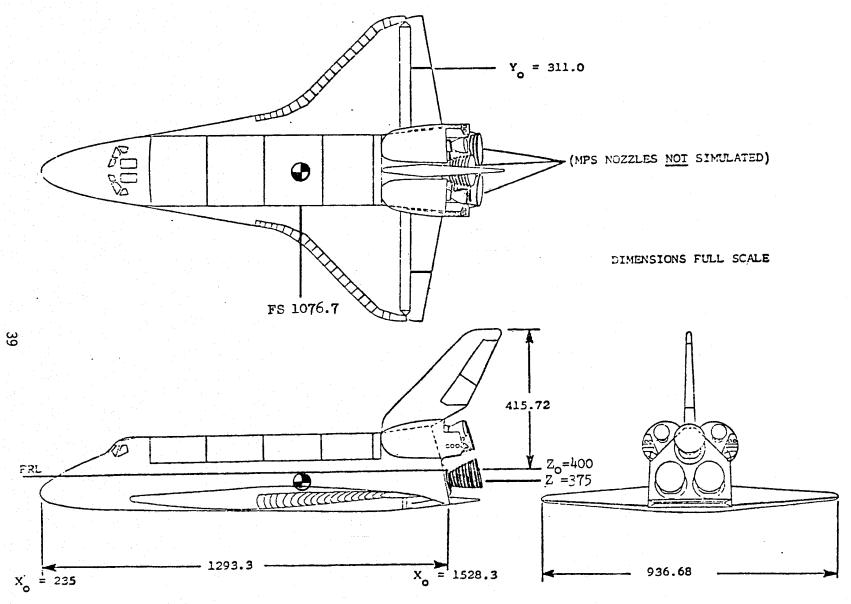
MODEL COMPONENT : VERTICAL - V8		
GENERAL DESCRIPTION Configuration 140A/	B Orbiter Ve	ertical Tail
MODEL SCALE: 0.015 DRAWING		-A00148,
DRAWING NUMBER VL70-000146A	RE	LEASE 6
DIMENSIONS:	FULL SCALE	MODEL SCALE
TOTAL DATA	î	
Area (Theo) - Ft ² Planform	413.253	0.093
Span (Theo) - In.	315.720	4.736
Aspect Ratio	1.675	1.675
Rate of Taper	0.507	0.507
Taper Ratio	0.404	0.404
Sweep-Back Angles, Degrees. Leading Edge	45.000	45.000
*Trailing Edge	26.2	26.2
0.25 Element Line	41.130	41.130
Chords:		
Root (Theo) WP	268,500	4,028
Tip (Theo) WP	108.470	1.627
MAC	199.808	2.997
Fus. Sta. of .25 MAC	1463.50	21.953
W.P. of .25 MAC	635.522	9.533
B.L. of .25 MAC	0.00	0.00
Airfoil Section	10.00	10.00
Leading Wedge Angle - Deg.	10.00	10.00
Trailing Wedge Angle - Deg.	14.920 2.00	14.920
Leading Edge Radius	2.00	0.030
Void Area	13.17	0.030
Blanketed Area	0.00	0.00

### TABLE III (Concluded)

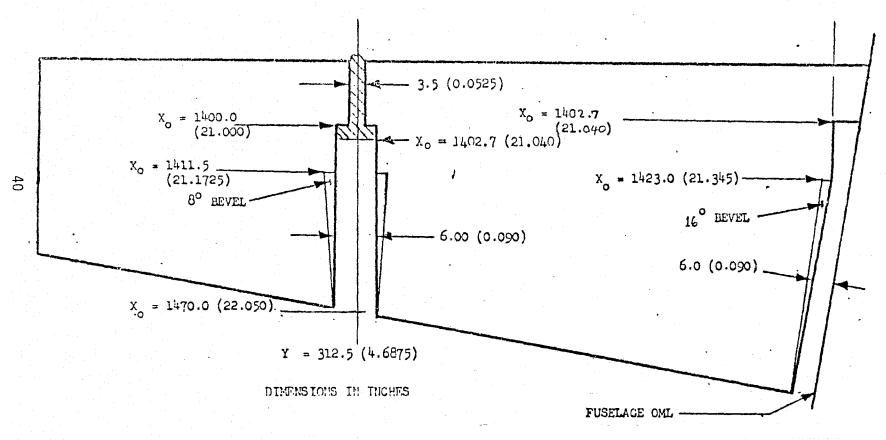
GENERAL DESCRIPTION: _	Configuration 4		
	NOTE: Identical to	W ₁₁₄ except airfoil	thickness.
•	Dihedral angle is a	long trailing edge o	f wing.
MODEL SCALE: 0.015	MODEL DRAWING:	SS-AG0148	
DRAWING NUMBER:	V70-30-906-01	(BCD)	
DIMENSIONS:		FULL-SCALE	MODEL SCAL
TOTAL DATA			
Area (Theo) I Planform Wetted Span (equiva	ft ² lent) (Theo) In.	2690.00 936.68	0.605
Aspect Ratio Rate of Tape Taper Ratio Dihedral Ang	<b>r</b>	2.265 1.177 0.200 3.500	2.265 1.177 0.200 3.500
Incidence An Aerodynamic Toe-In Angle Cant Angle	gle, degrees Twist, degrees	0.500 +3.000	0.500 +3,000
Leading E Trailing 0.25 Elem Chords:	Edge ent Line	45.000 -10.056 35.209	45.000 -10.056 35,209
Root (Win Tip, (equ MAC	g Sta. 0.0) (Theo) Bivalent)(Theo) B.P.	137.85 474.81	10.339 2.068 7.122
Fus. Sta. W.P. of . B.L. of . Airfoil Sect	25 MAC	1136.83 290.58 182.13	17.052 4.359 2.732
Root Tip EXPOSED DATA			•
Area Ft ² Span, (equiv Aspect Ratio		2.059	0.394 10.810 2.059
Taper Ratio Chords Root BP10 Tip 1.00	08 0 b - <b>2</b>	0.245 	6.245 8.431 2.068
MAC Fus. Sta. W.P. of	. of .25 MAC .25 MAC	392,83 1185,98 294,30	5,892 17,790 4,415

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Figure 1. - Axis Systems.



(a) SSV Orbiter Configuration Figure 2. - Model sketches.

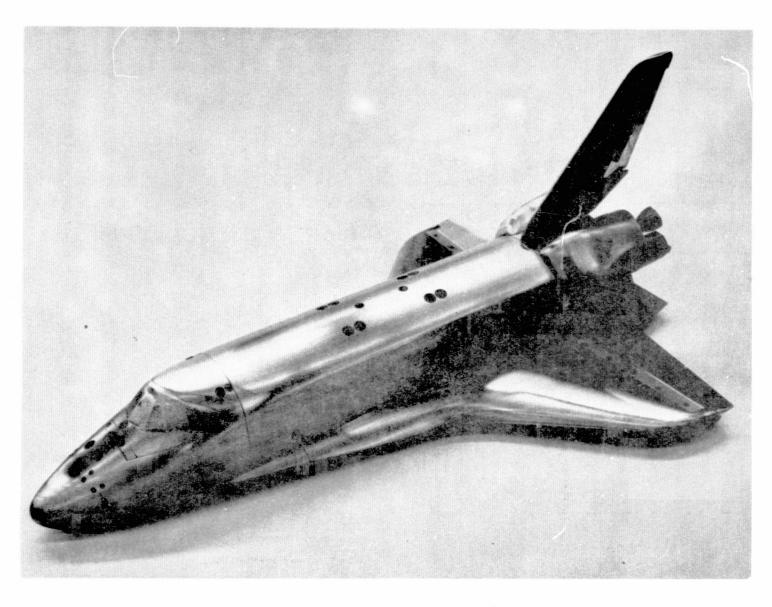


b. Slotted Elevon E₄₃ (6-inch gap) Figure 2. - Continued.

FILLET 0.1 inch strip of no. 100 grit at 0.5 inch measured streamwise MAIN WING and VERTICAL TAIL 0.1 inch strip of no. 120 grit at 0.5 inch measured streamwise NOSE 0.1 inch strip of no. 120 grit

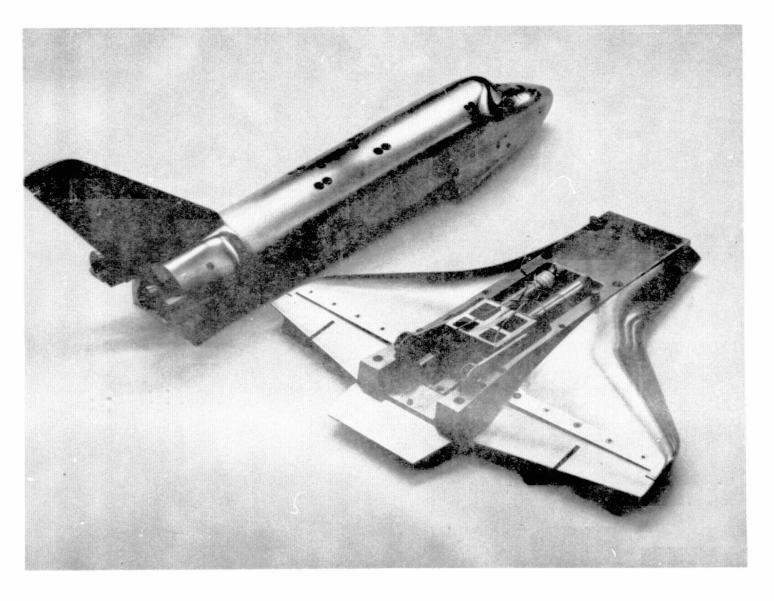
c. Position of Transition Grit Used in Investigation
 Figure 2. - Concluded.

at 1.2 inch measured streamwise



a. Orbiter Configuration, Front, 3/4 View Figure 3. Model Photographs

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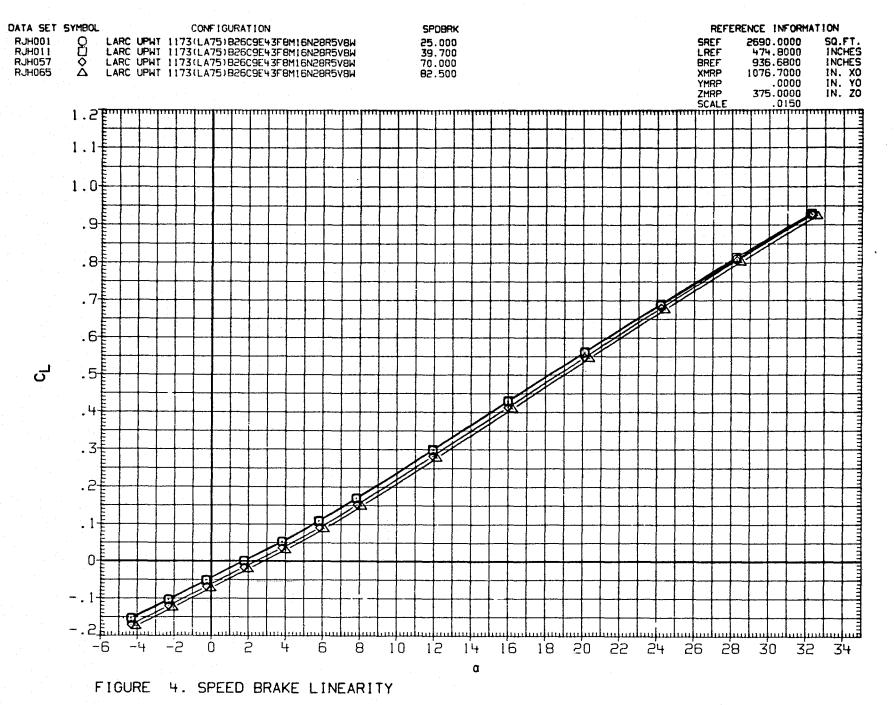
b. Orbiter Configuration, Rear, 3/4 View Figure 3. Concluded.

### DATA FIGURES

VOLUME 1 (pages 1 through 639)

VOLUME 2 (pages 640 through 850)

<u>(</u>)



PAGE

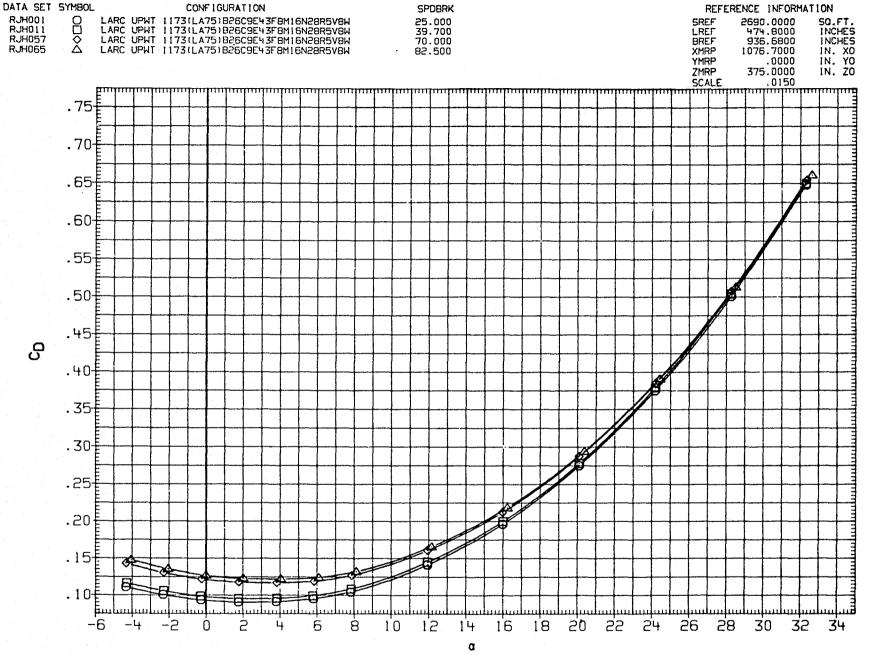


FIGURE 4. SPEED BRAKE LINEARITY

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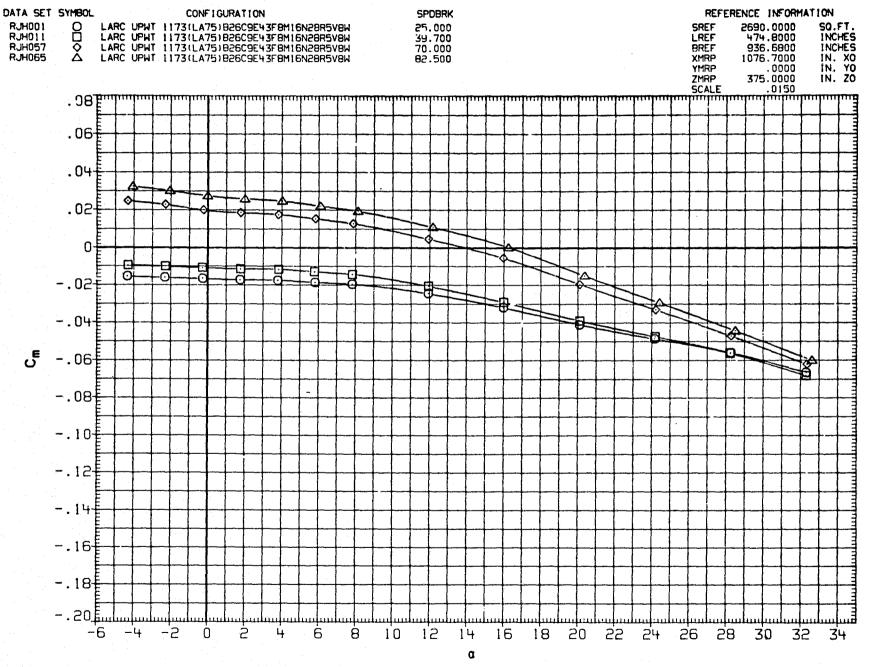


FIGURE 4. SPEED BRAKE LINEARITY

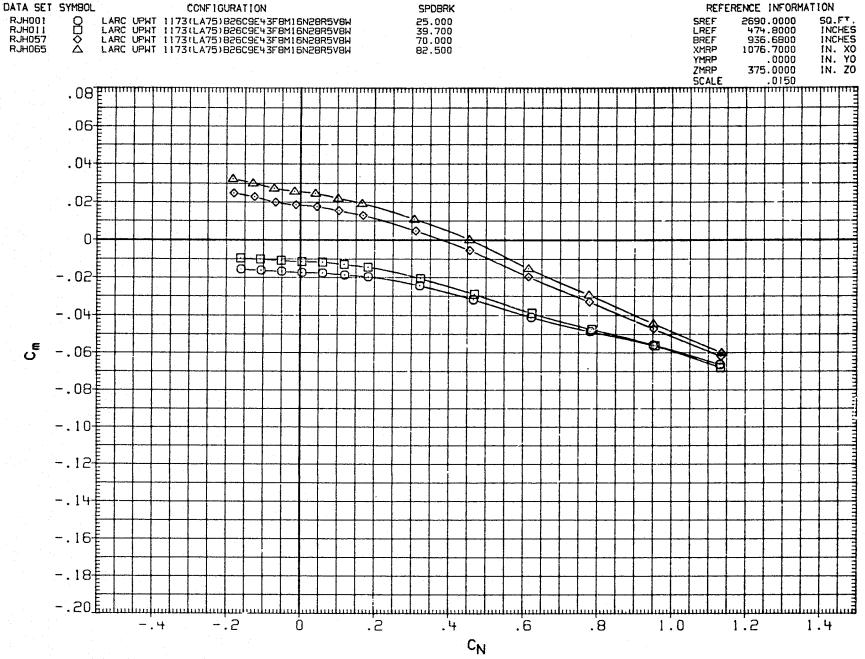


FIGURE 4. SPEED BRAKE LINEARITY

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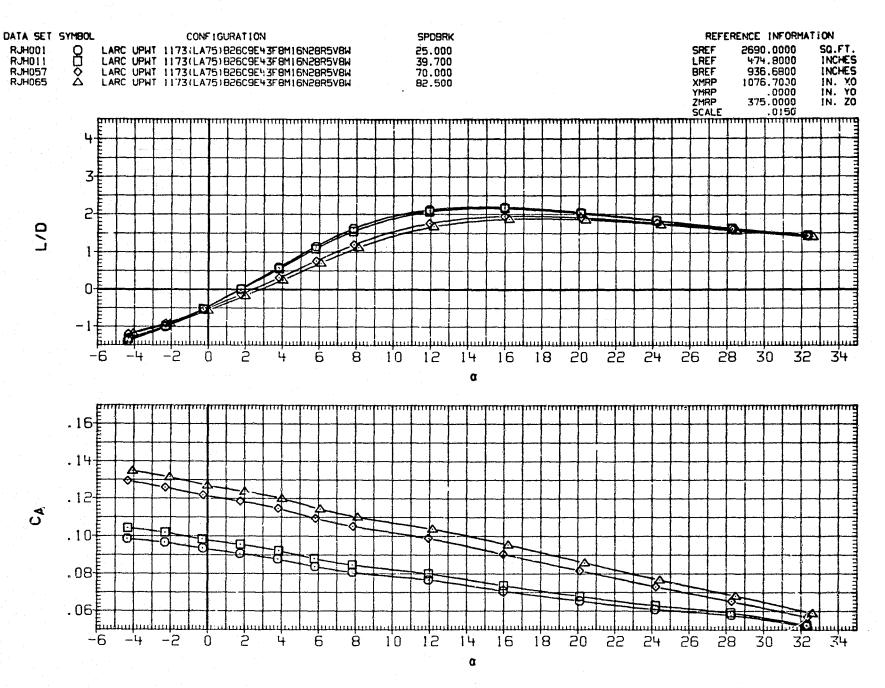


FIGURE 4. SPEED BRAKE LINEARITY

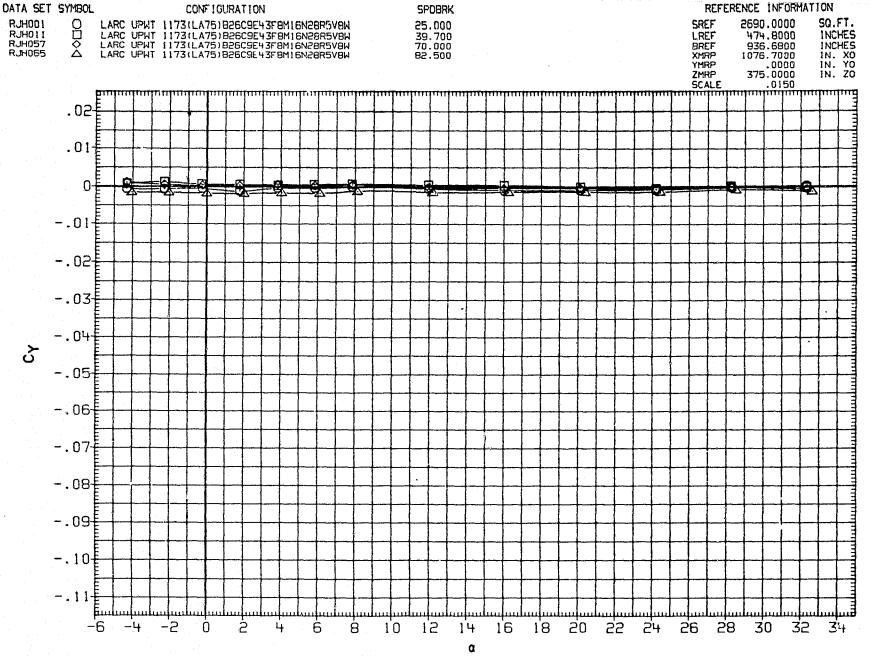


FIGURE 4. SPEED BRAKE LINEARITY

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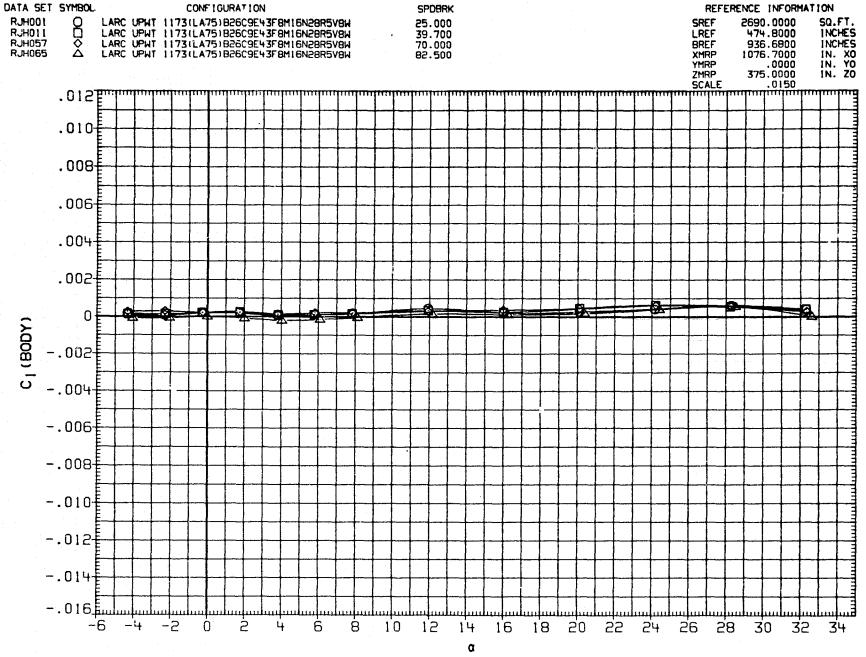


FIGURE 4. SPEED BRAKE LINEARITY

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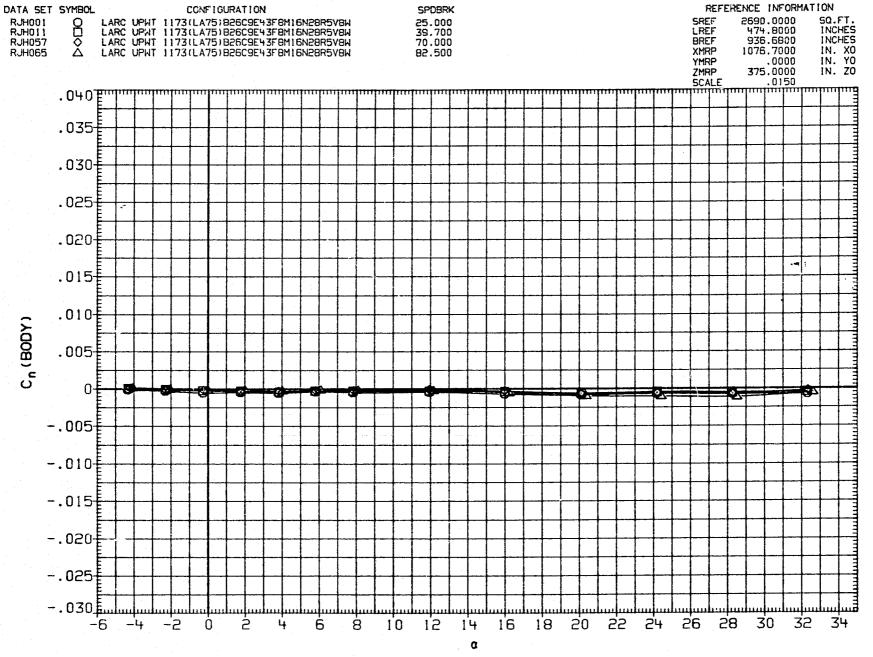


FIGURE 4. SPEED BRAKE LINEARITY

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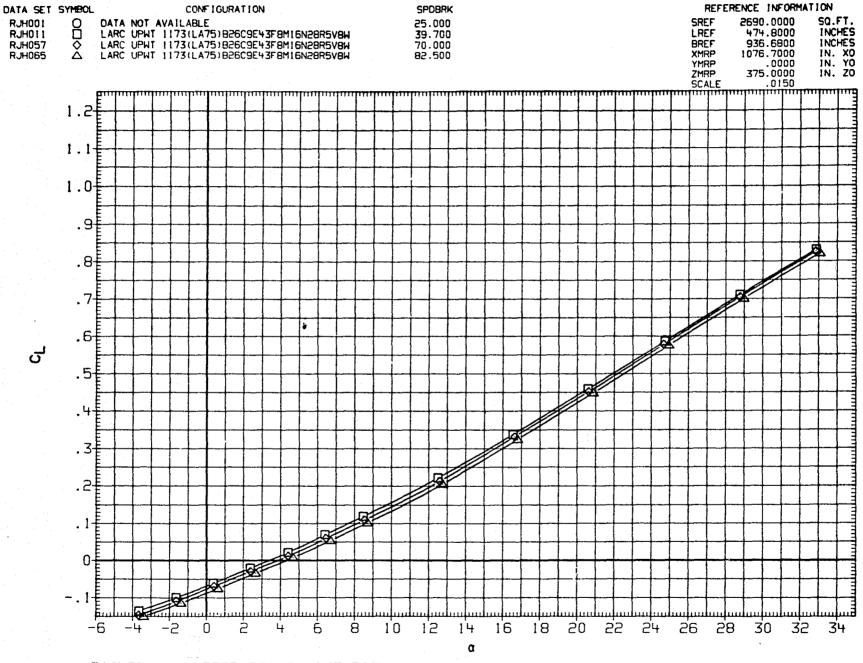


FIGURE 4. SPEED BRAKE LINEARITY

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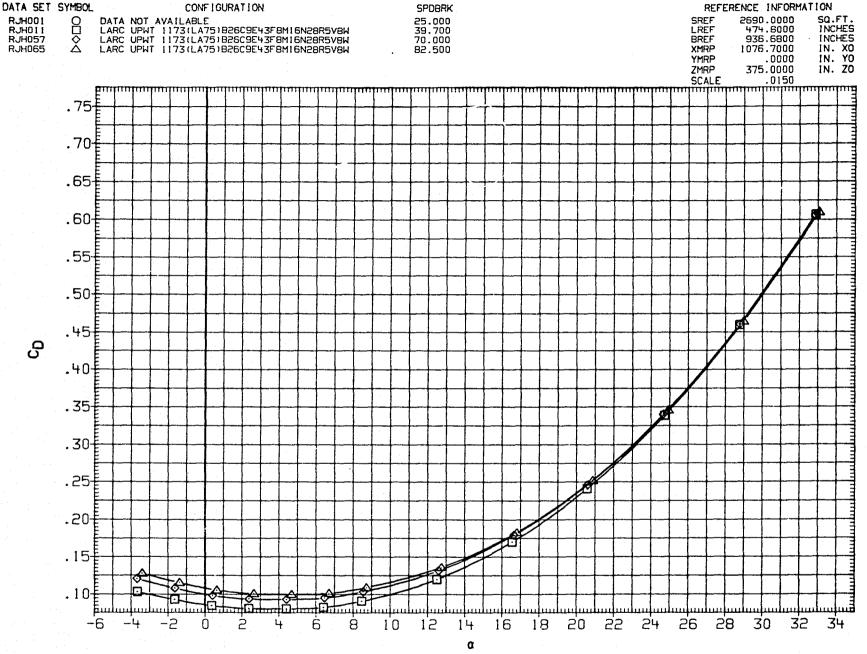


FIGURE 4. SPEED BRAKE LINEARITY

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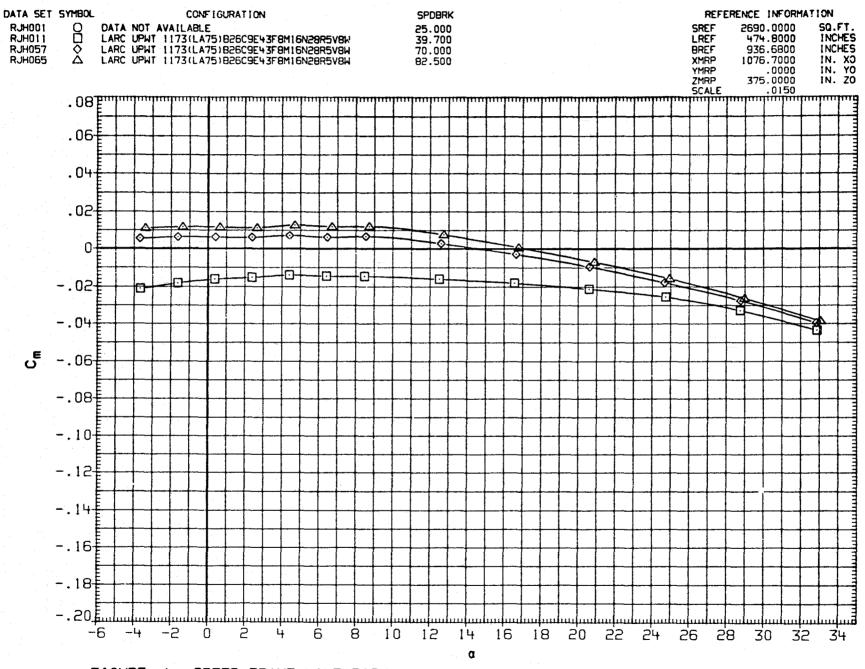


FIGURE 4. SPEED BRAKE LINEARITY

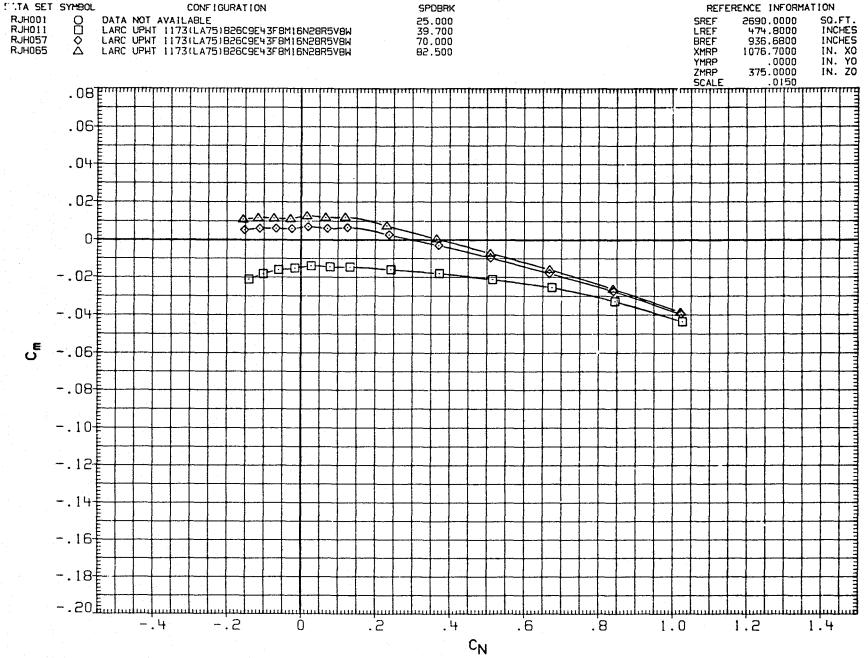


FIGURE 4. SPEED BRAKE LINEARITY

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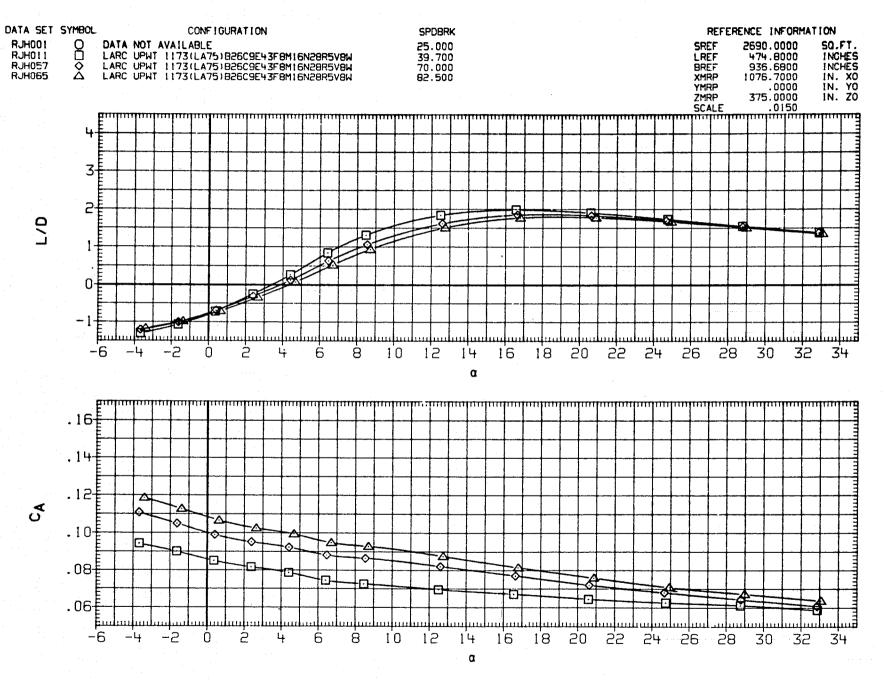


FIGURE 4. SPEED BRAKE LINEARITY

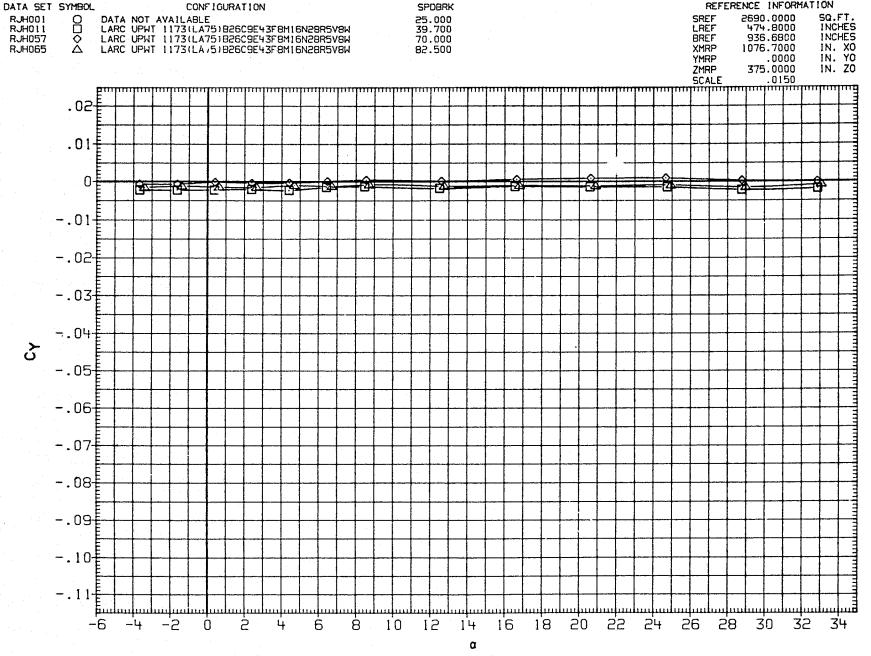


FIGURE 4. SPEED BRAKE LINEARITY

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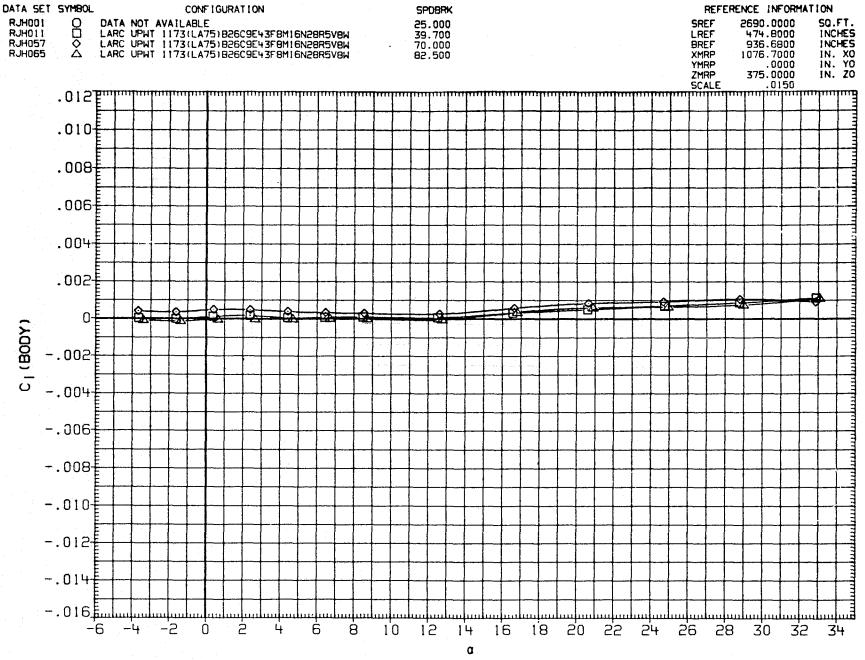


FIGURE 4. SPEED BRAKE LINEARITY

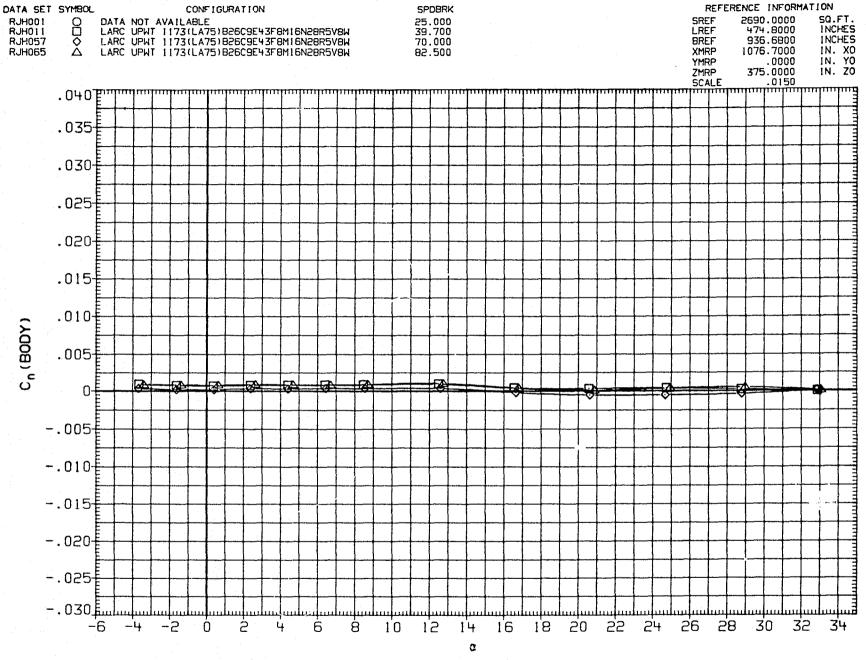
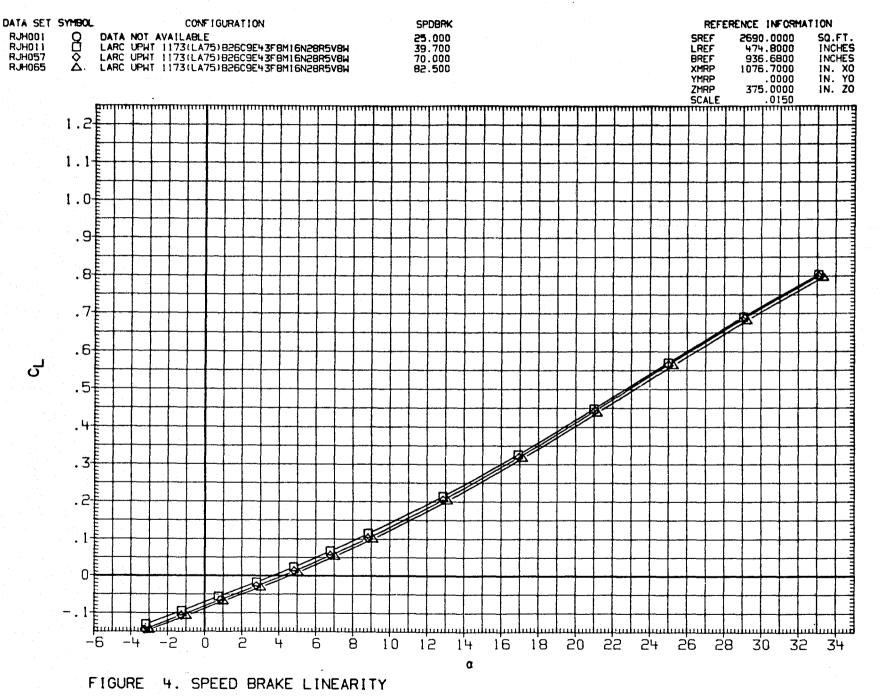


FIGURE 4. SPEED BRAKE LINEARITY

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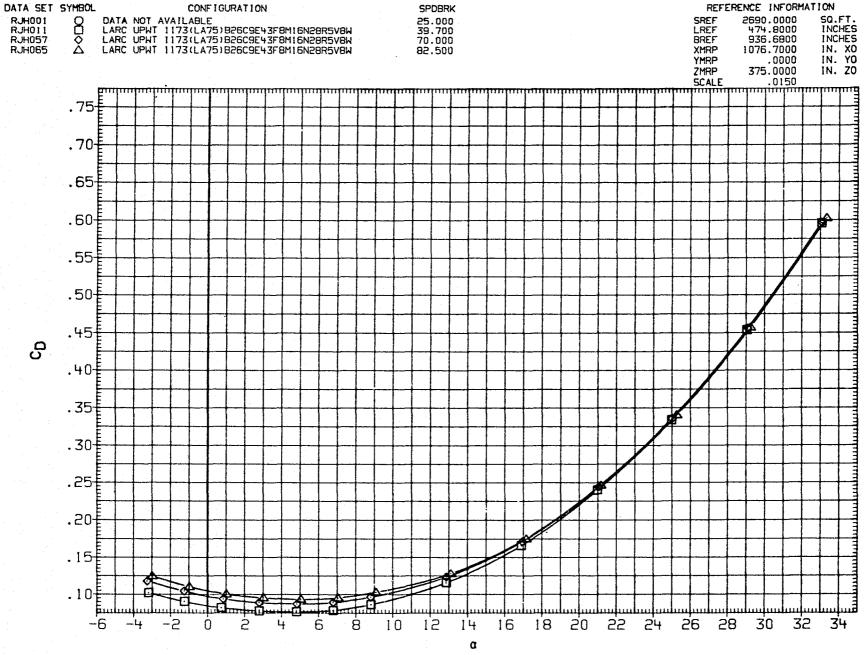


FIGURE 4. SPEED BRAKE LINEARITY

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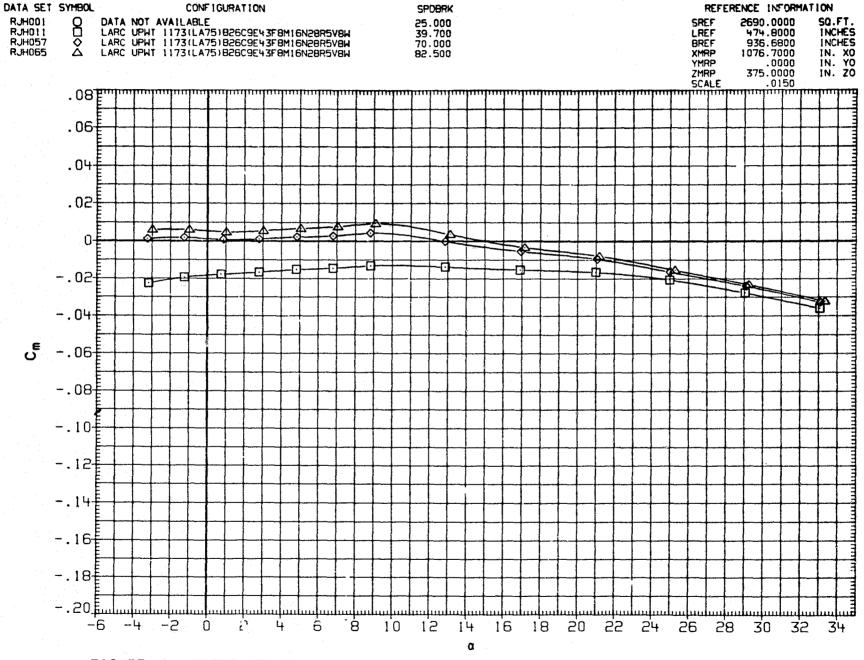


FIGURE 4. SPEED BRAKE LINEARITY

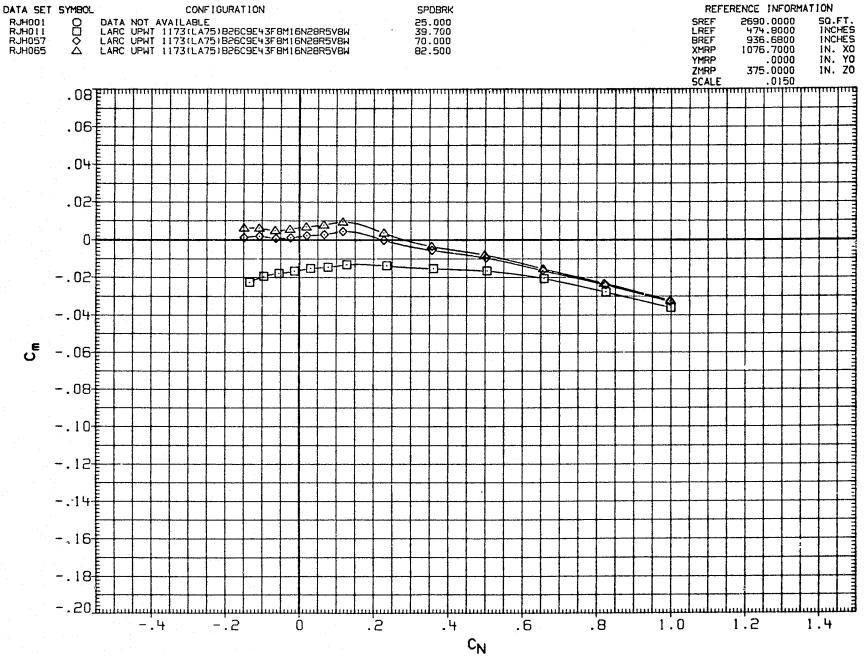


FIGURE 4. SPEED BRAKE LINEARITY

PAGE

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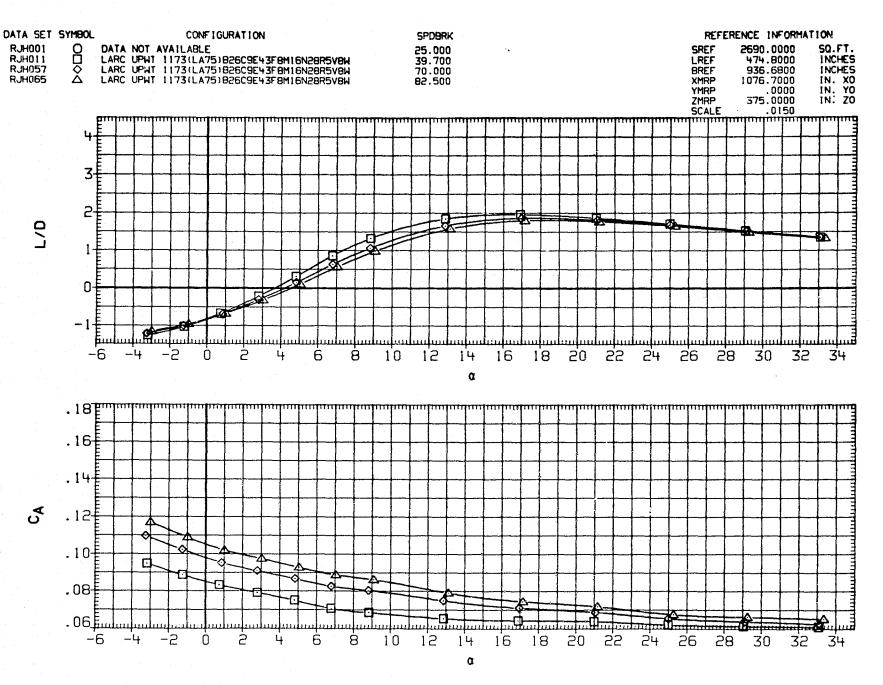


FIGURE 4. SPEED BRAKE LINEARITY

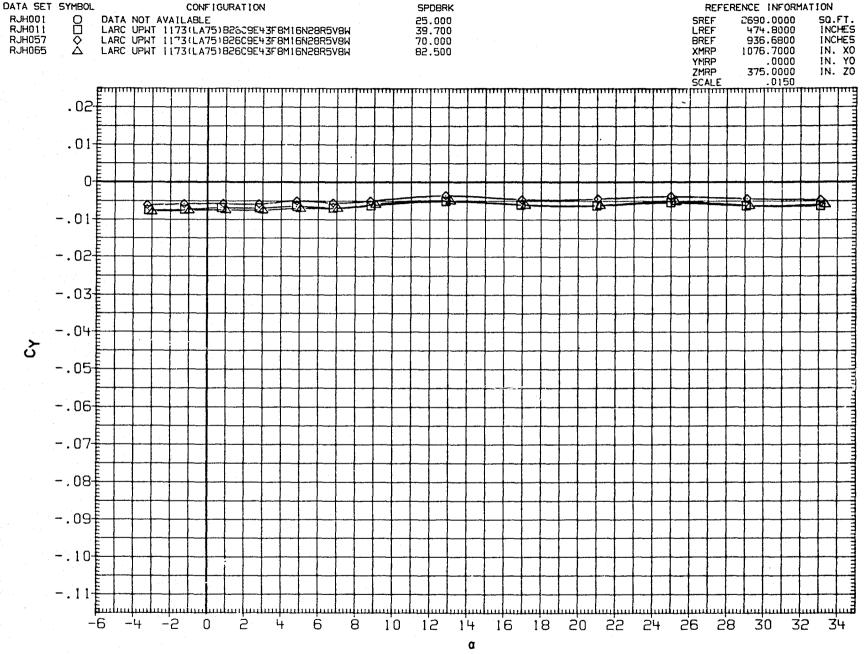


FIGURE 4. SPEED BRAKE LINEARITY

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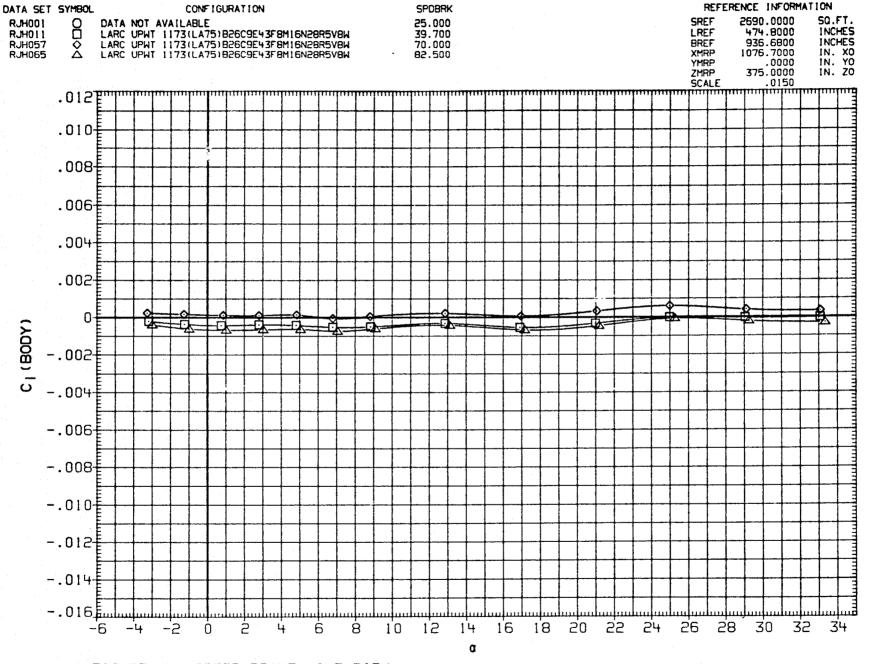


FIGURE 4. SPEED BRAKE LINEARITY

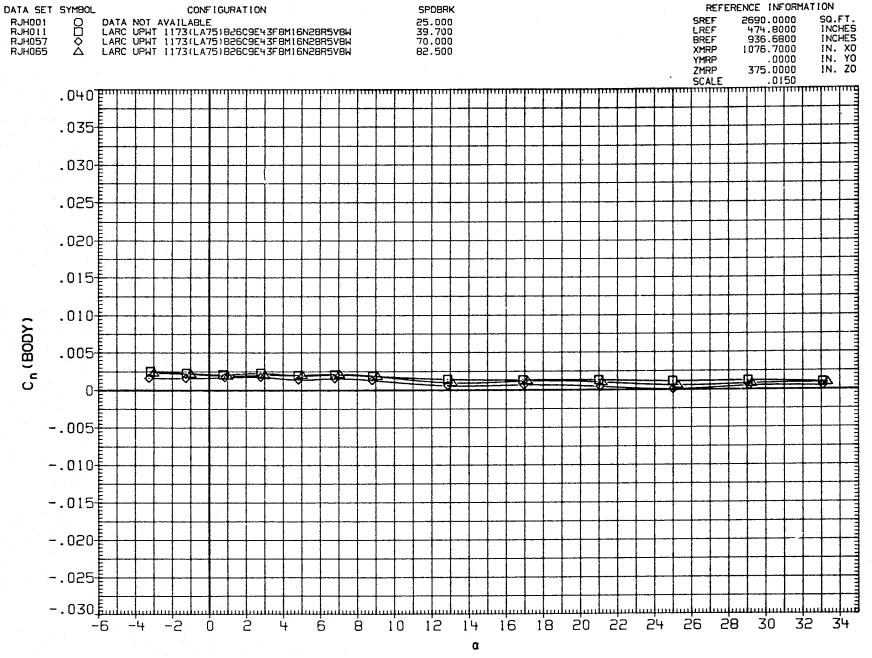


FIGURE 4. SPEED BRAKE LINEARITY

PAGE 24

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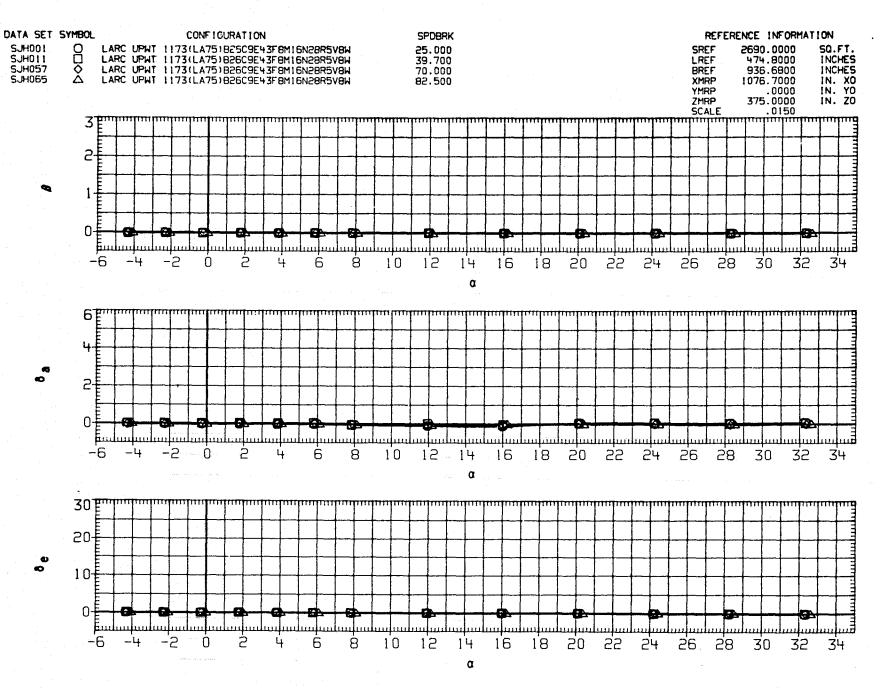


FIGURE 4. SPEED BRAKE LINEARITY

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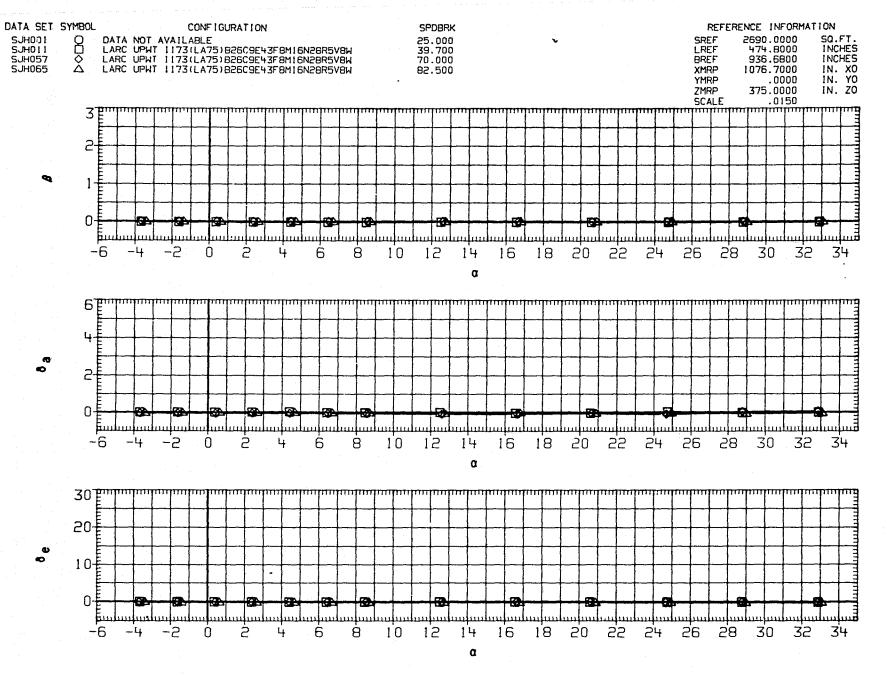


FIGURE 4. SPEED BRAKE LINEARITY

(B)MACH = 3.90

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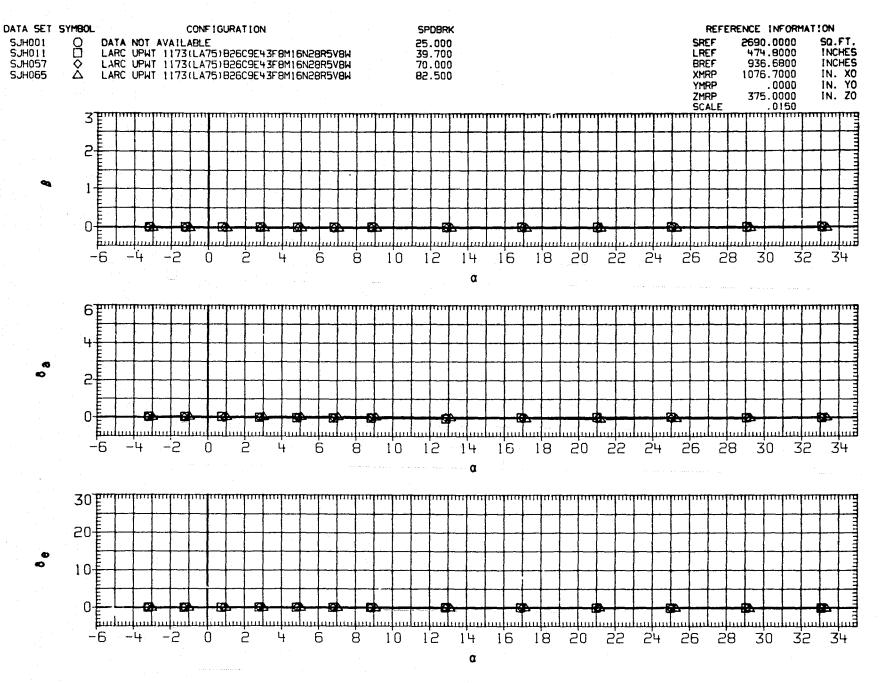


FIGURE 4. SPEED BRAKE LINEARITY

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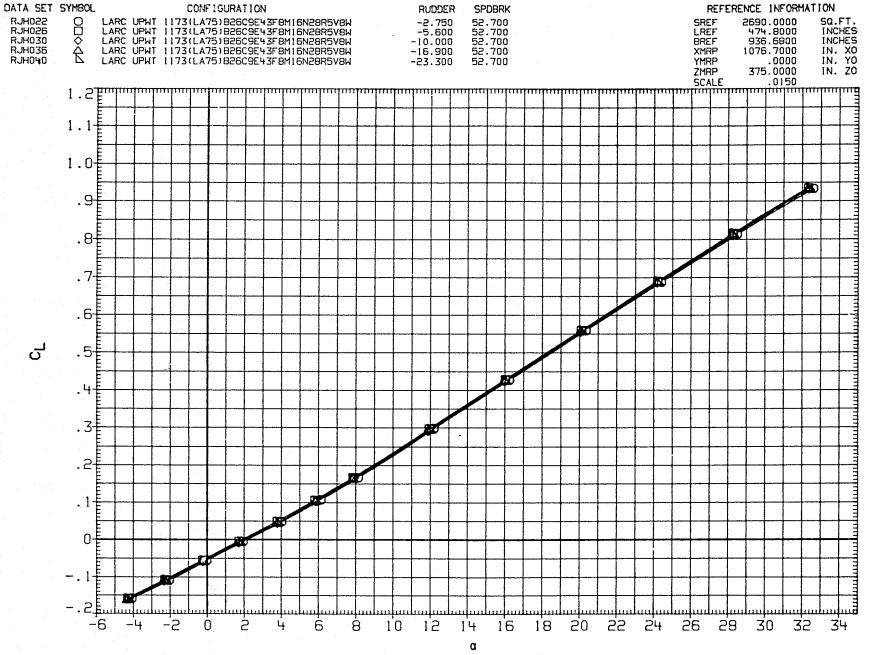


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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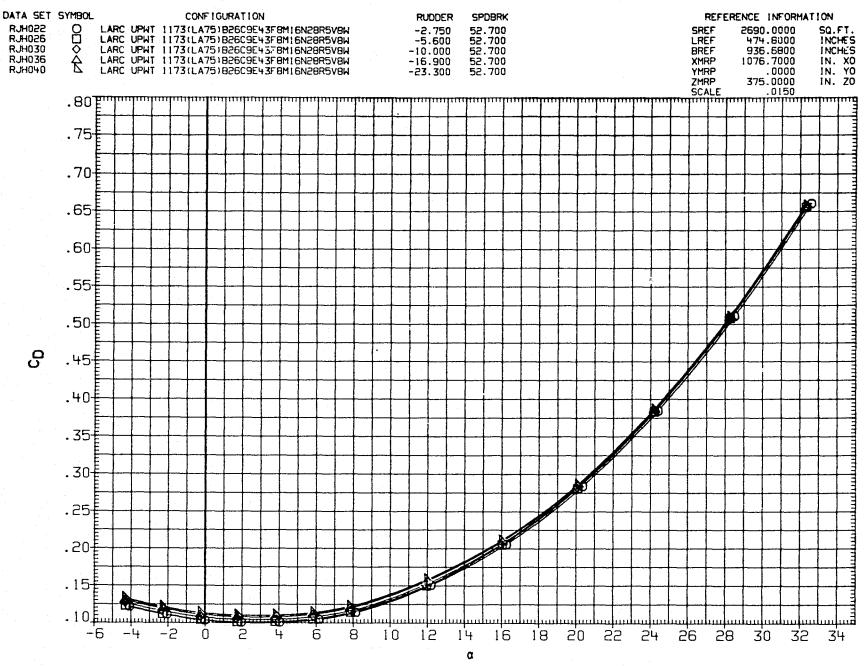


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

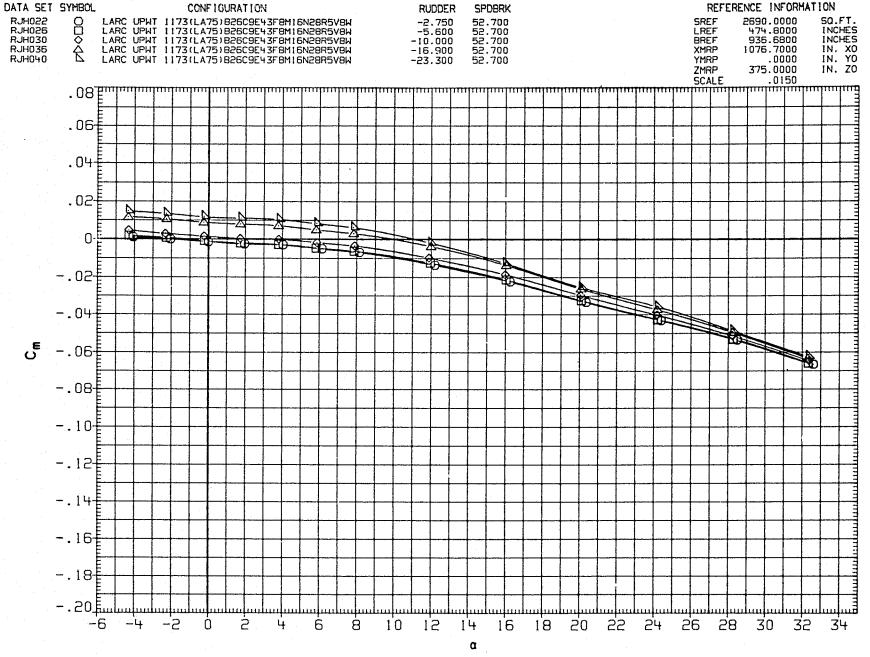


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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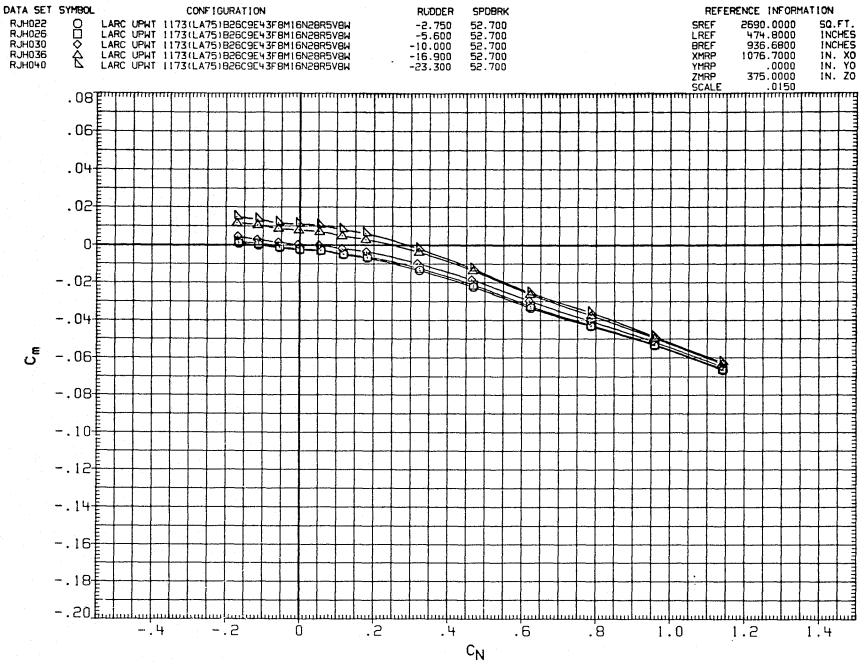


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

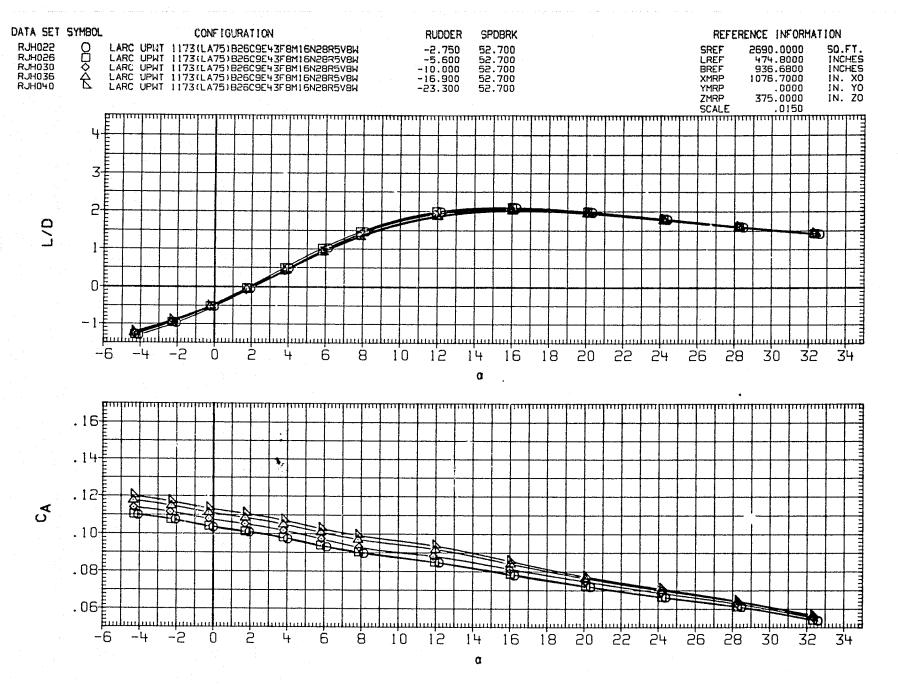


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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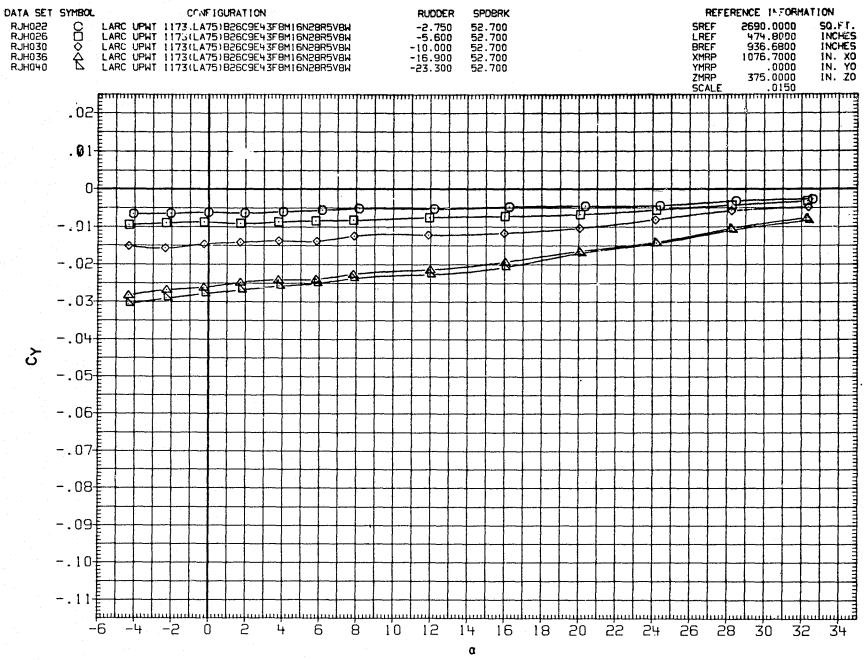


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

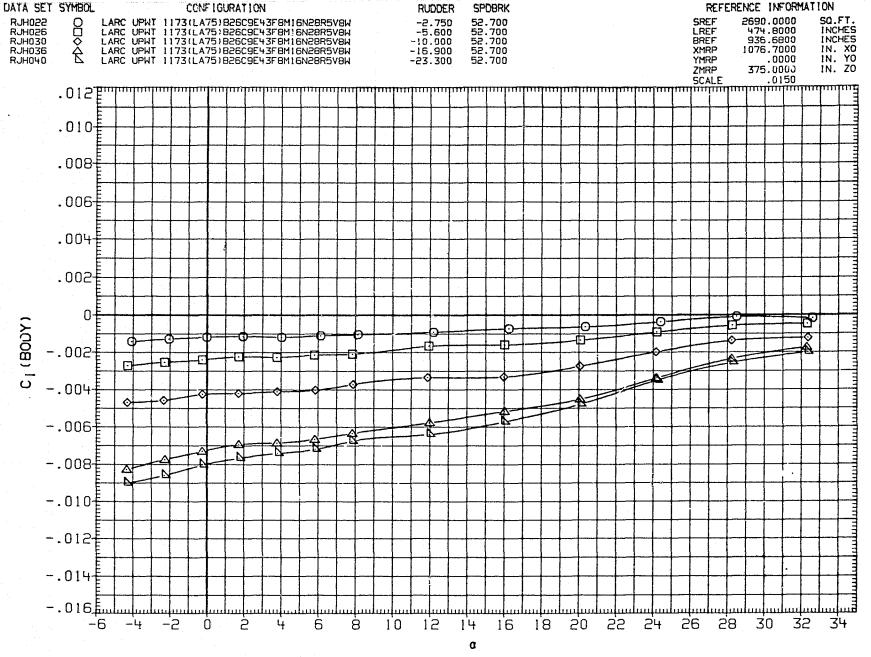


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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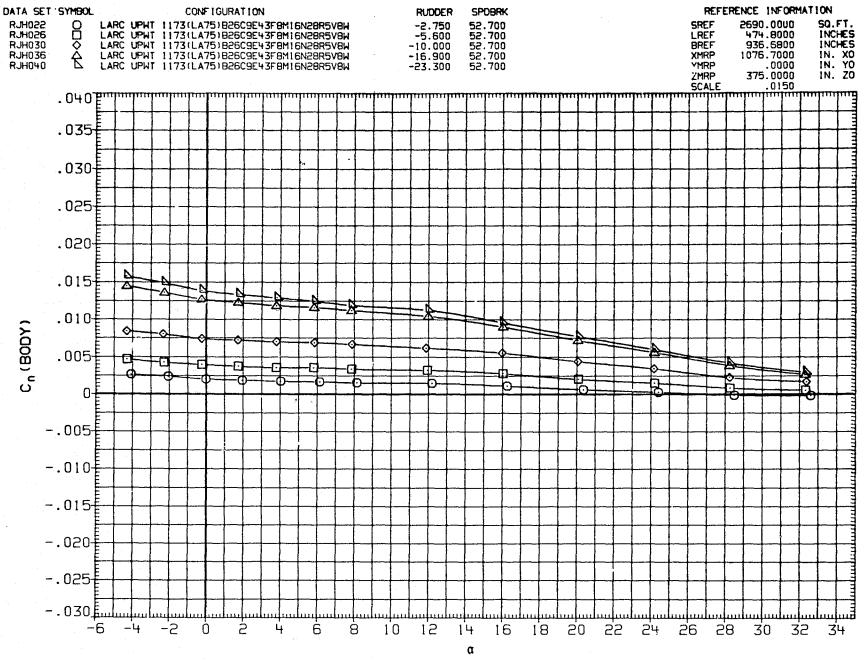


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

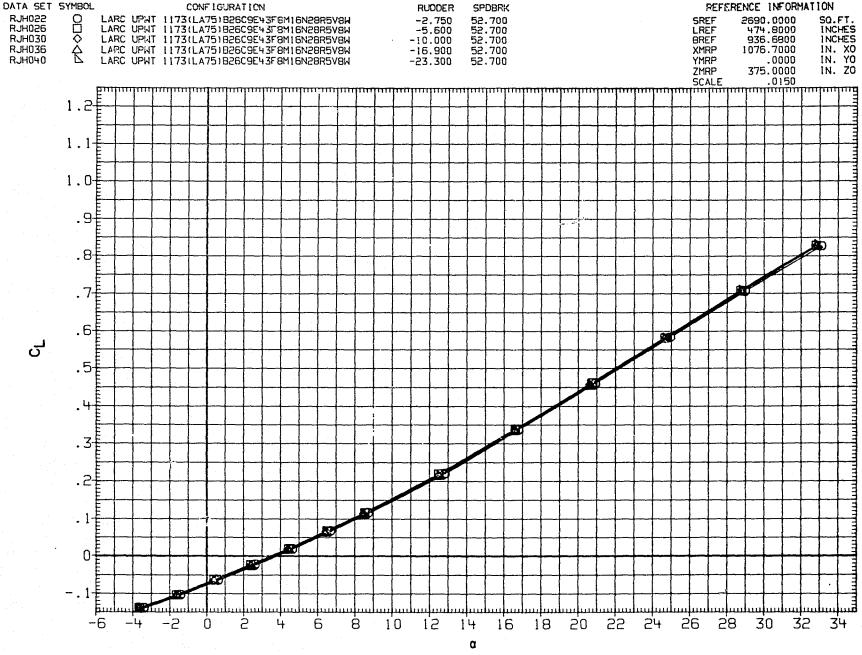


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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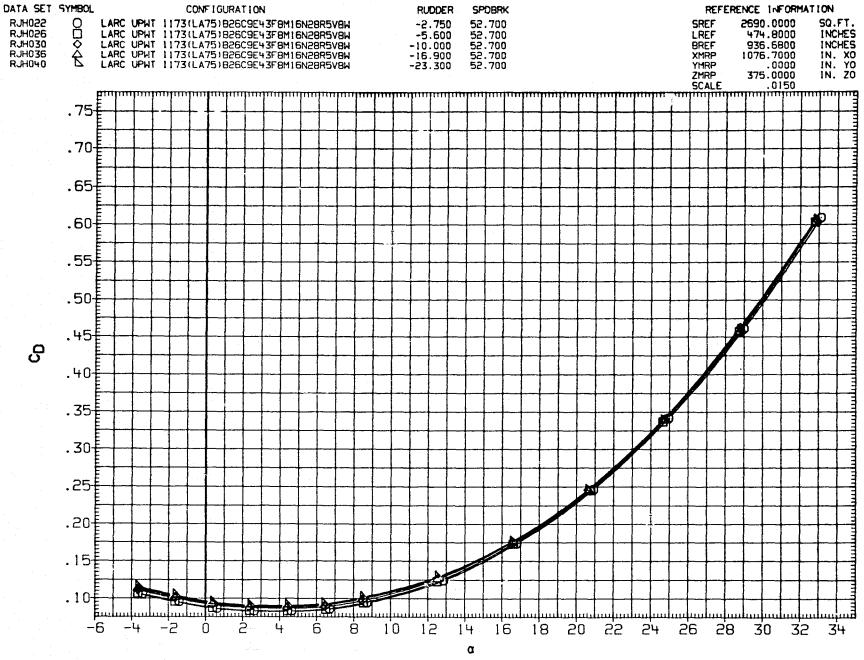


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

(B)MACH = 3.90

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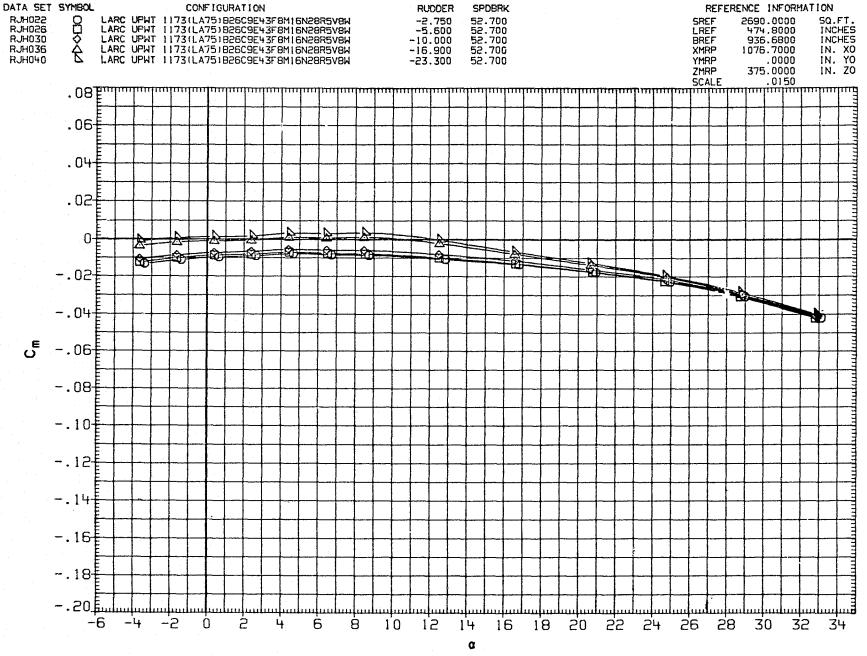


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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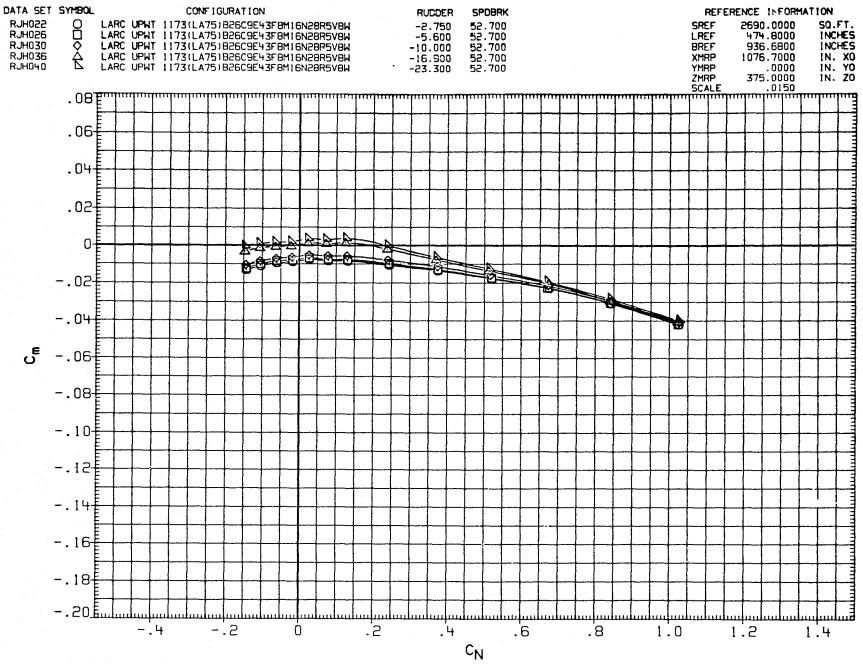


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

(B)MACH = 3.90

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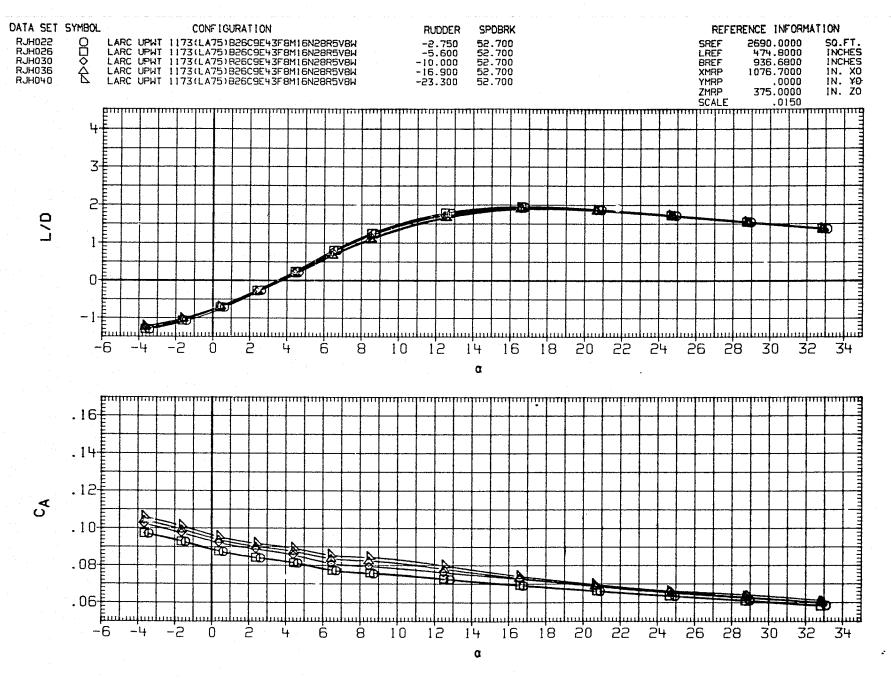


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

(B)MACH = 3.90

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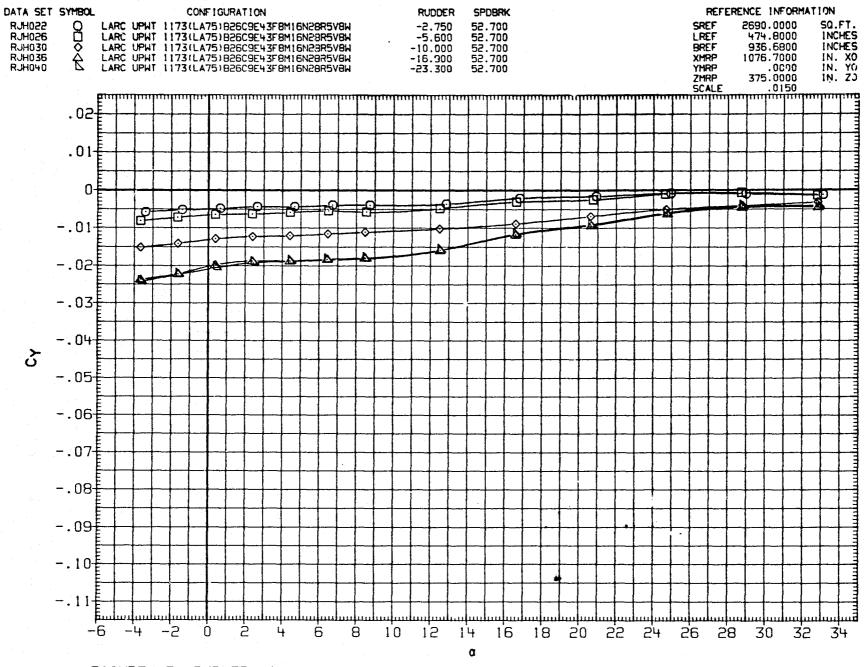


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

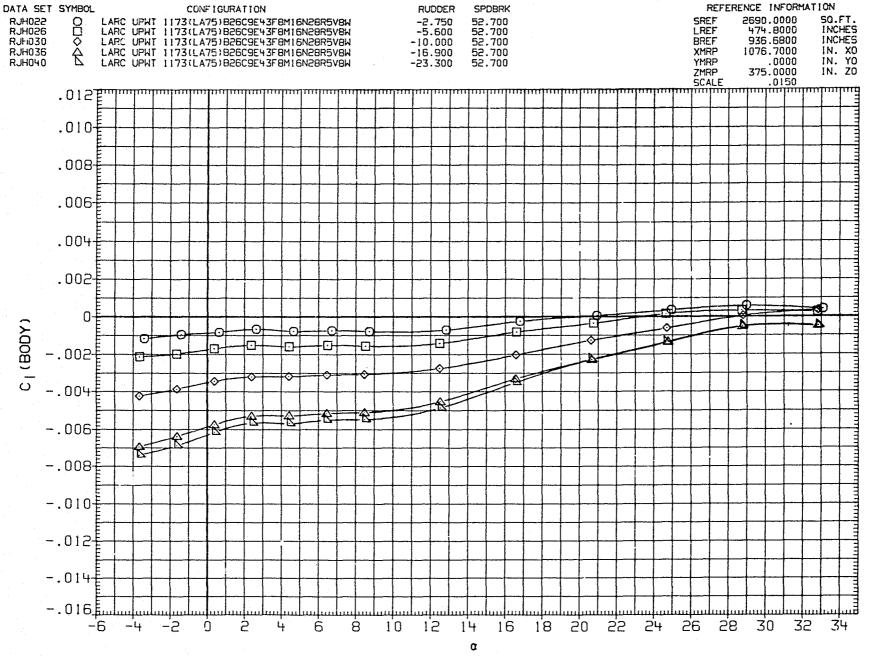


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

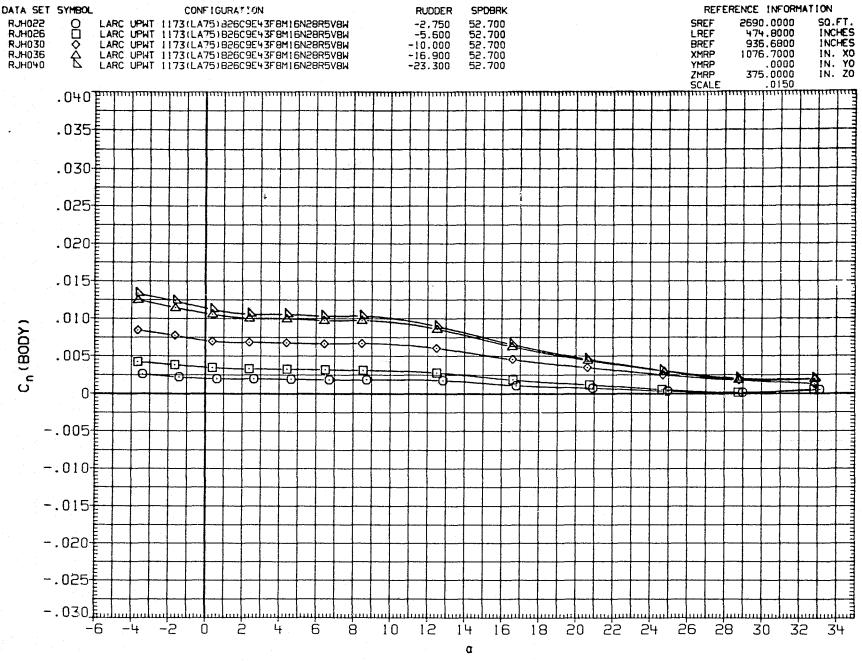


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

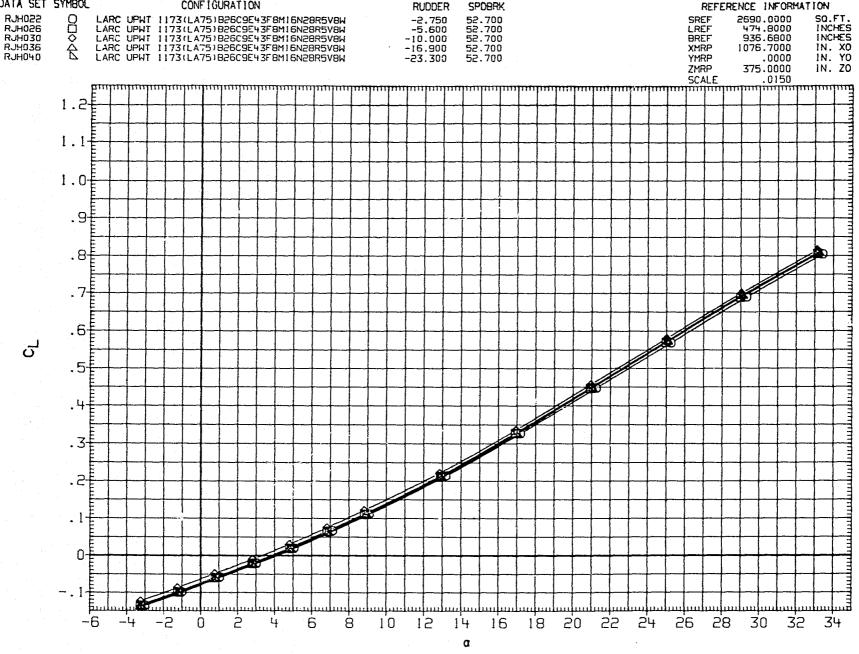


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

DATA SET SYMBOL

CONFIGURATION

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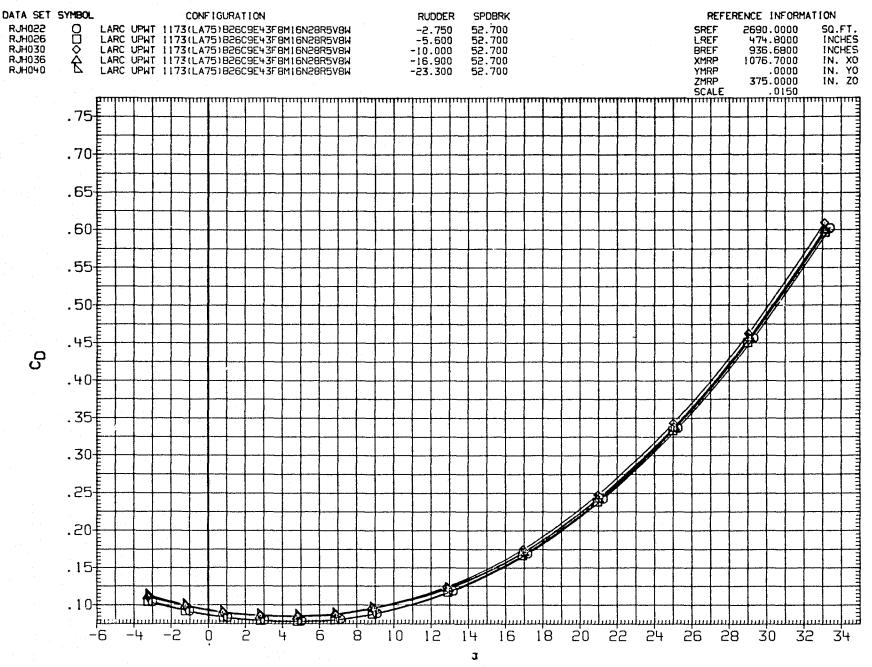


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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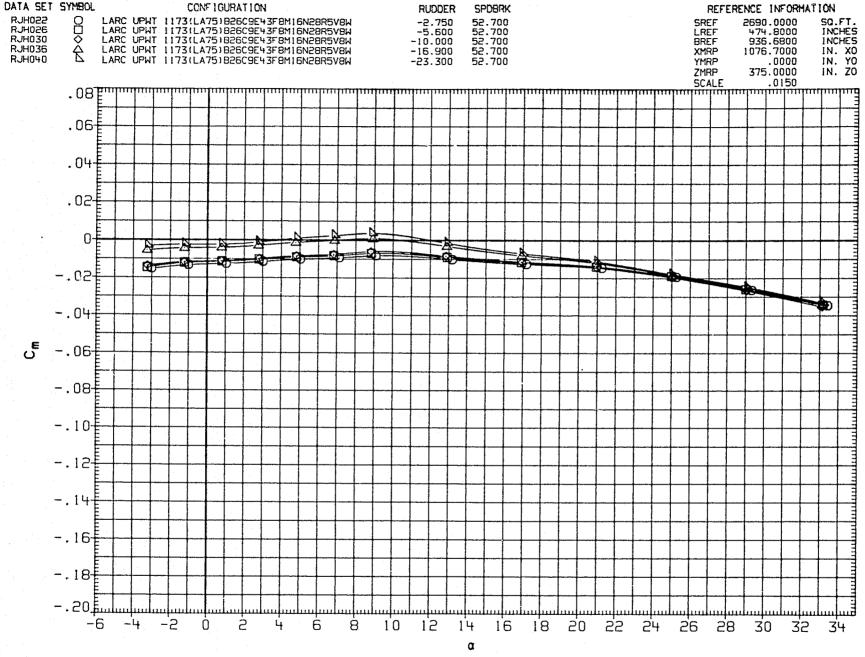


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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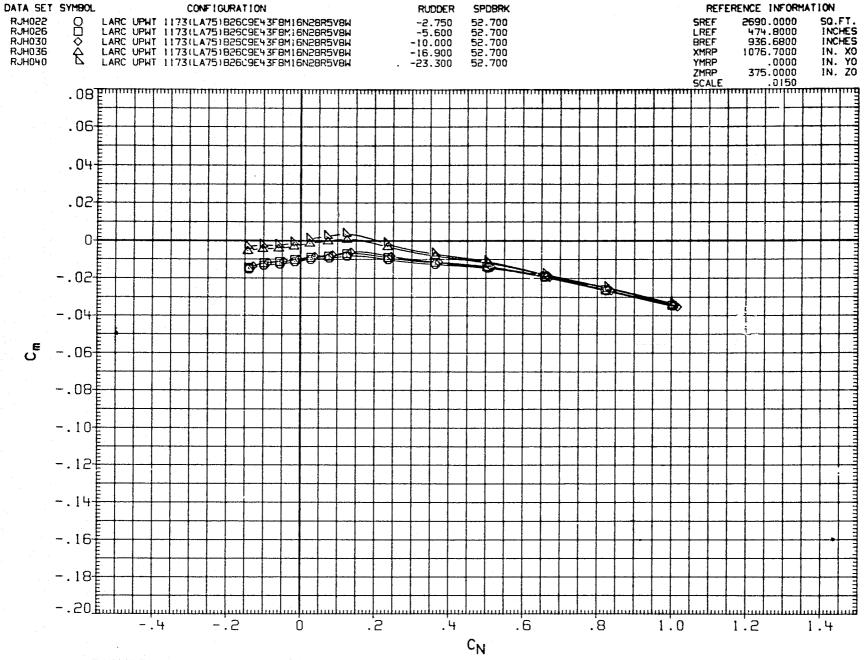


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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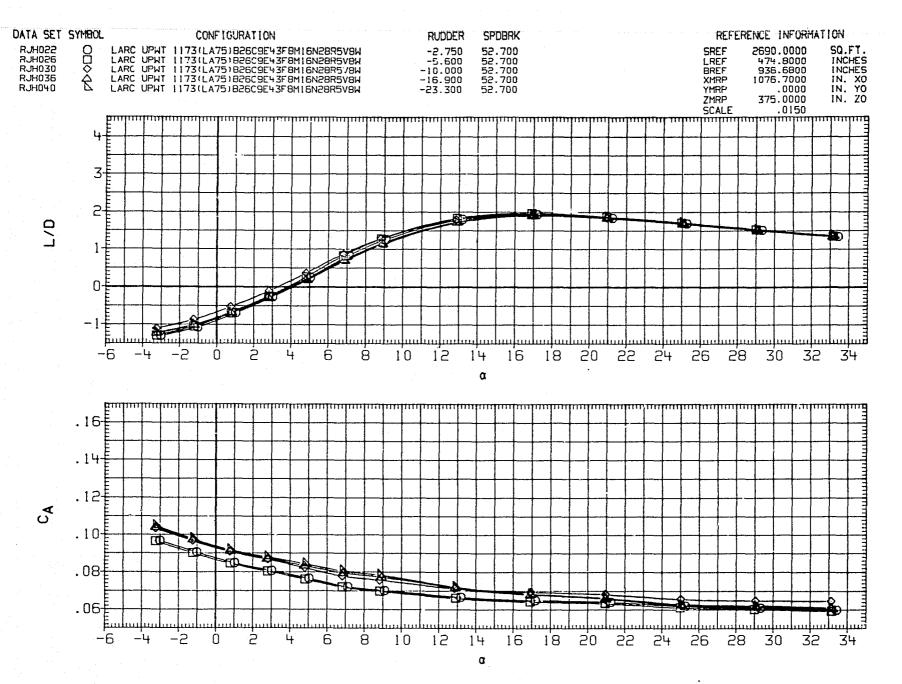


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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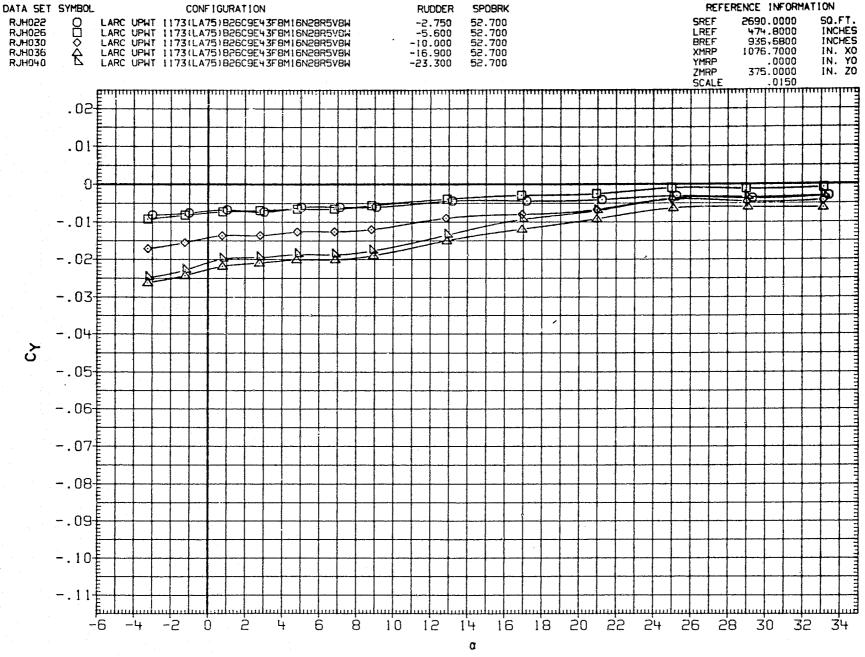


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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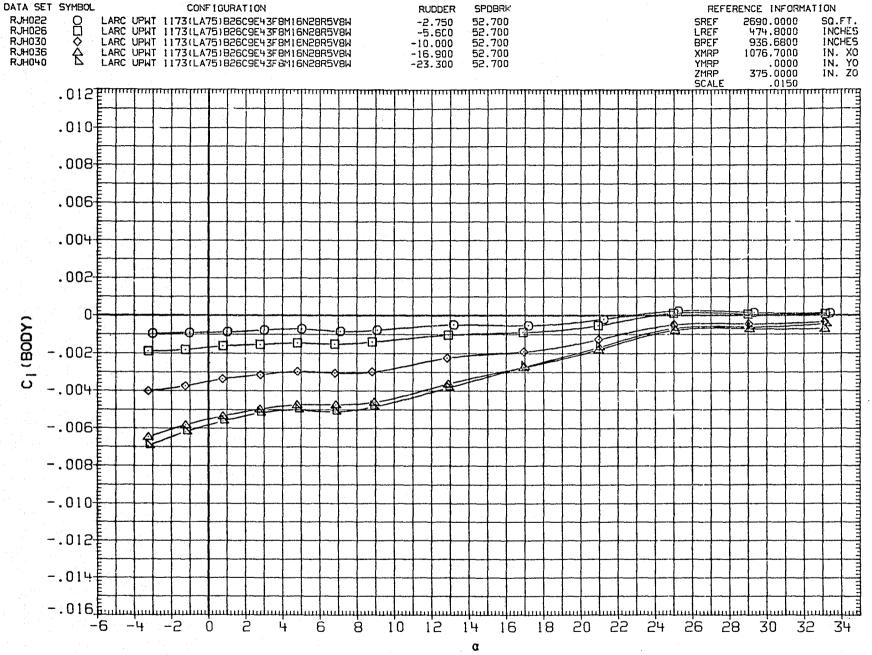


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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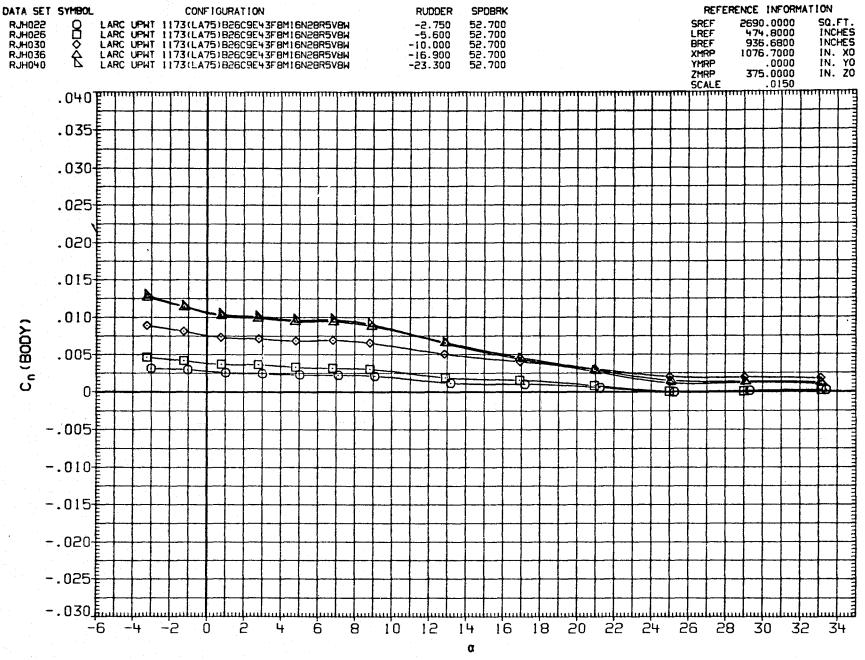


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

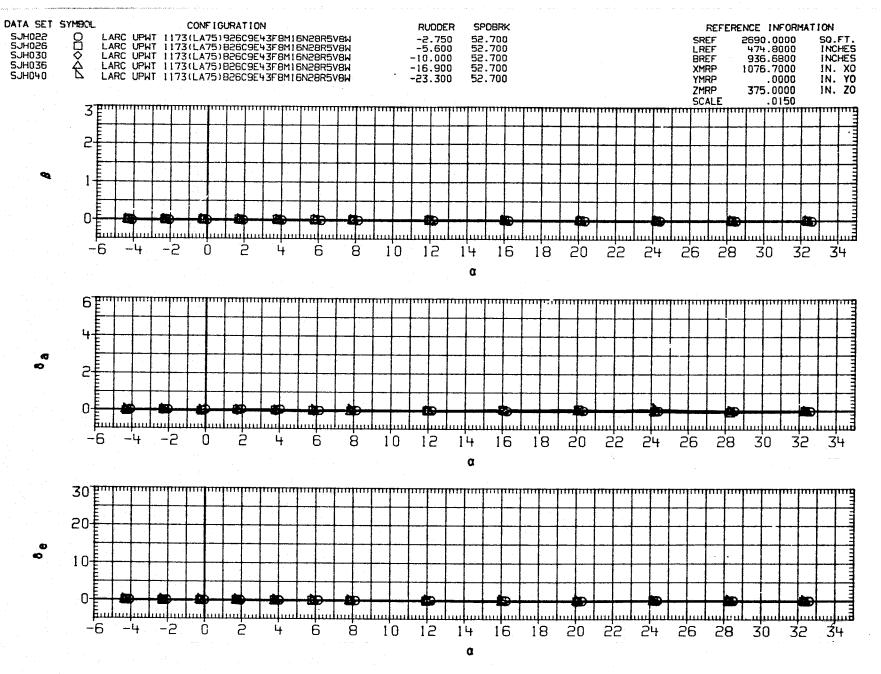


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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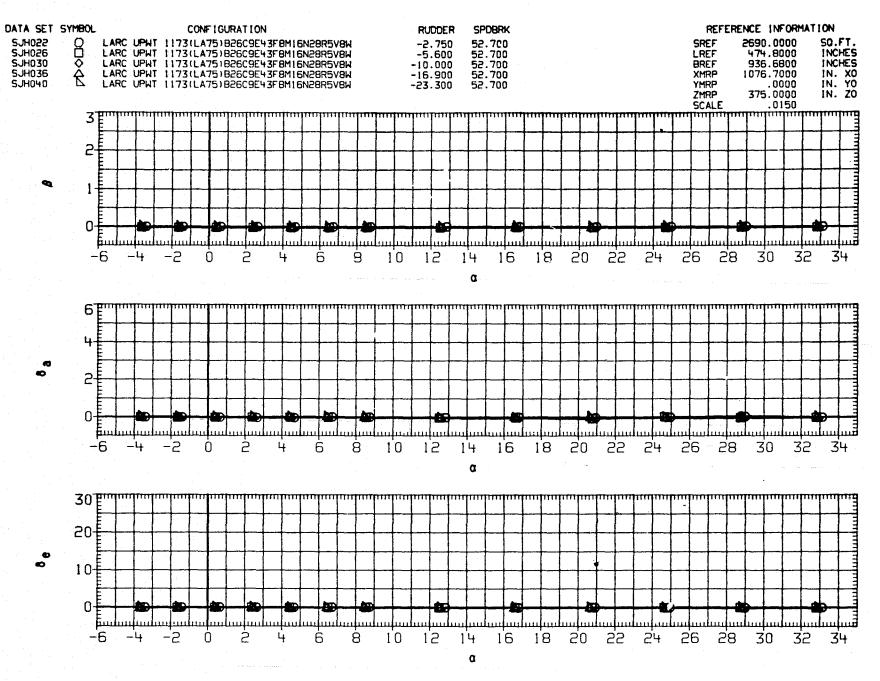


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

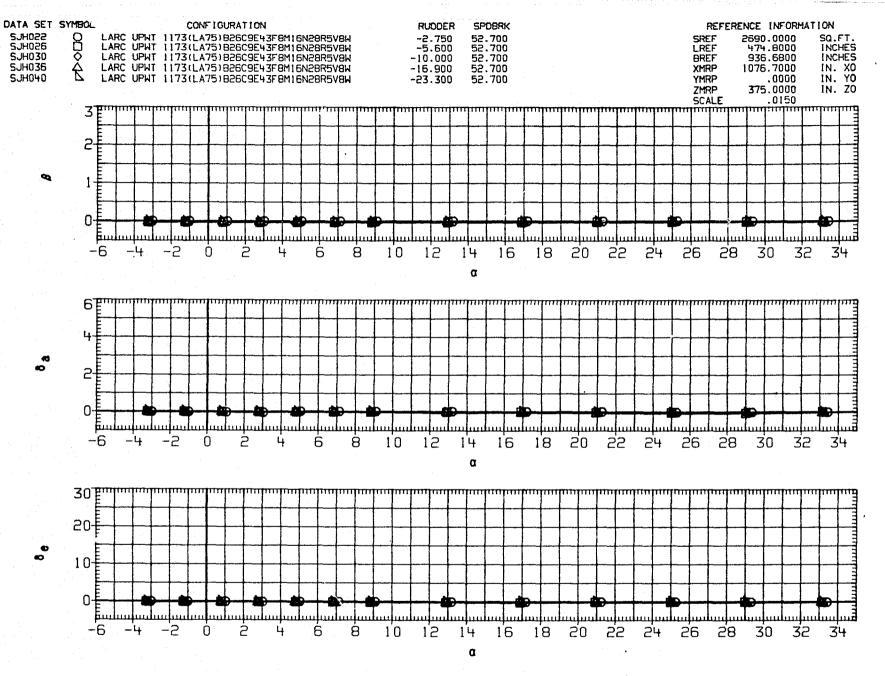


FIGURE 5. RUDDER LINEARITY, SPEED BRAKE AT 52.7 DEG.

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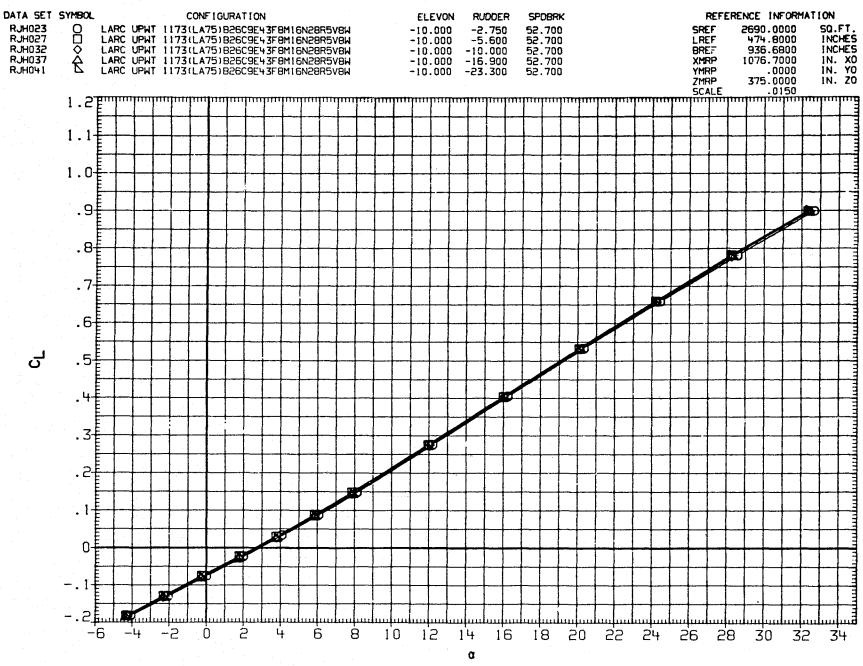


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

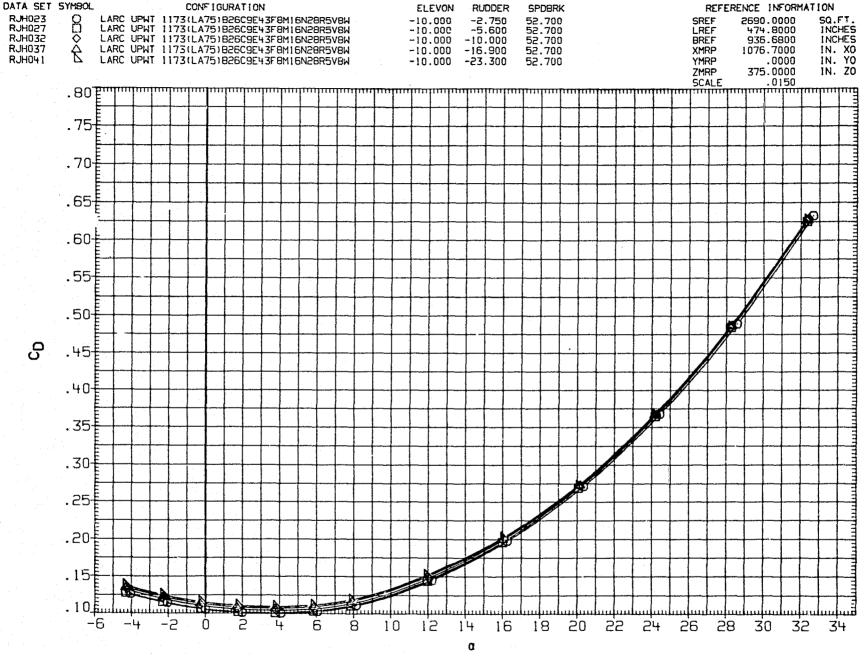


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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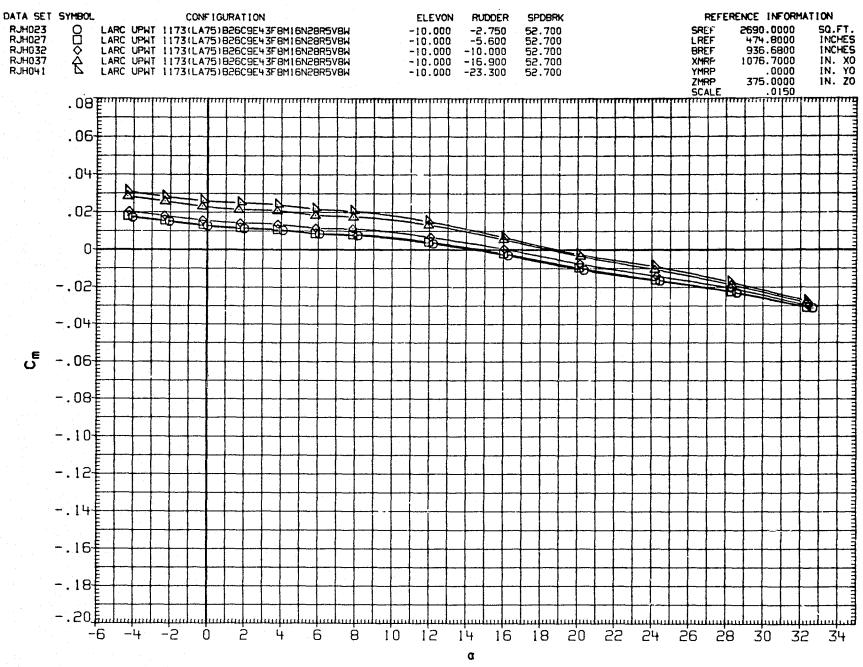


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

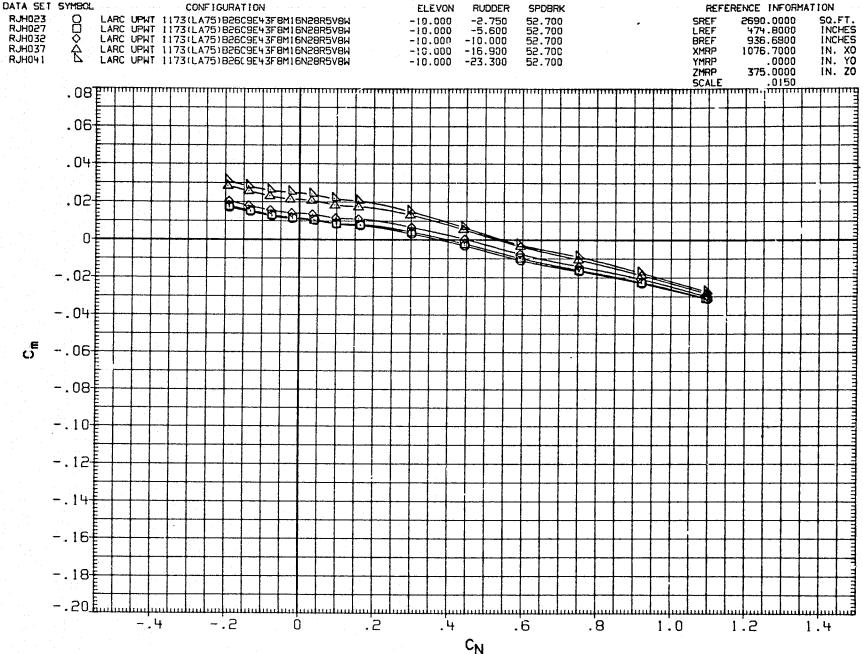


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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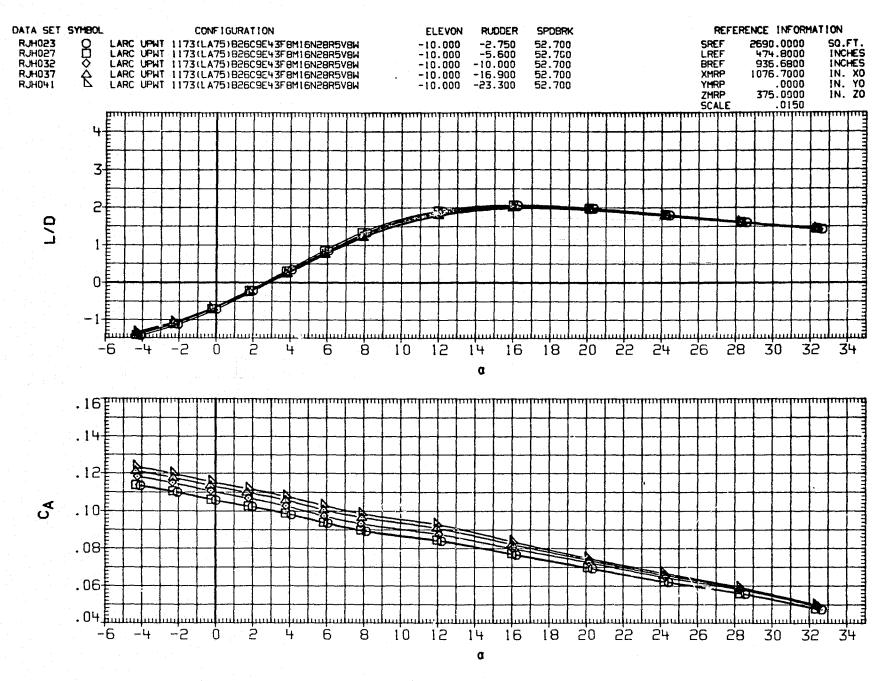


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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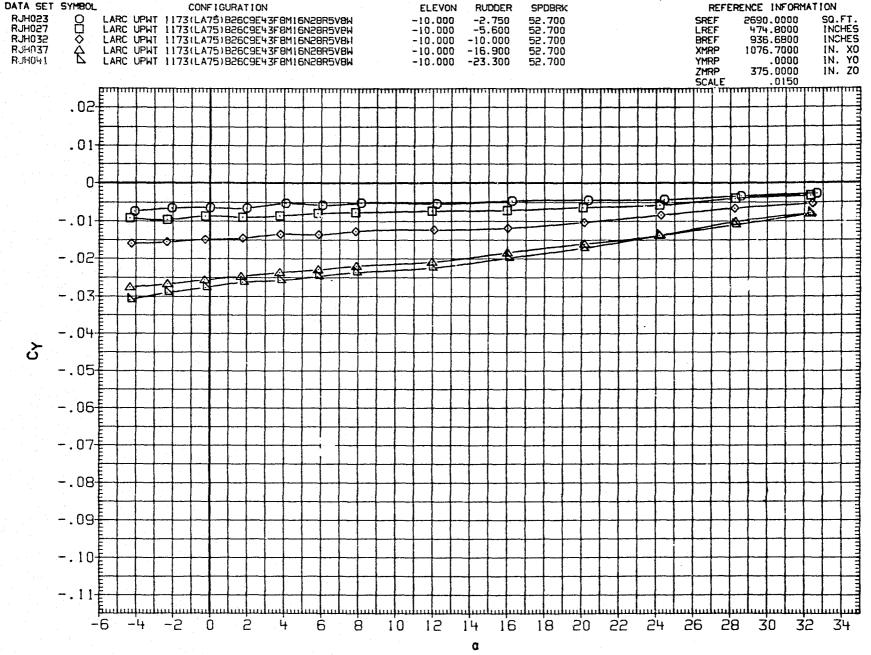


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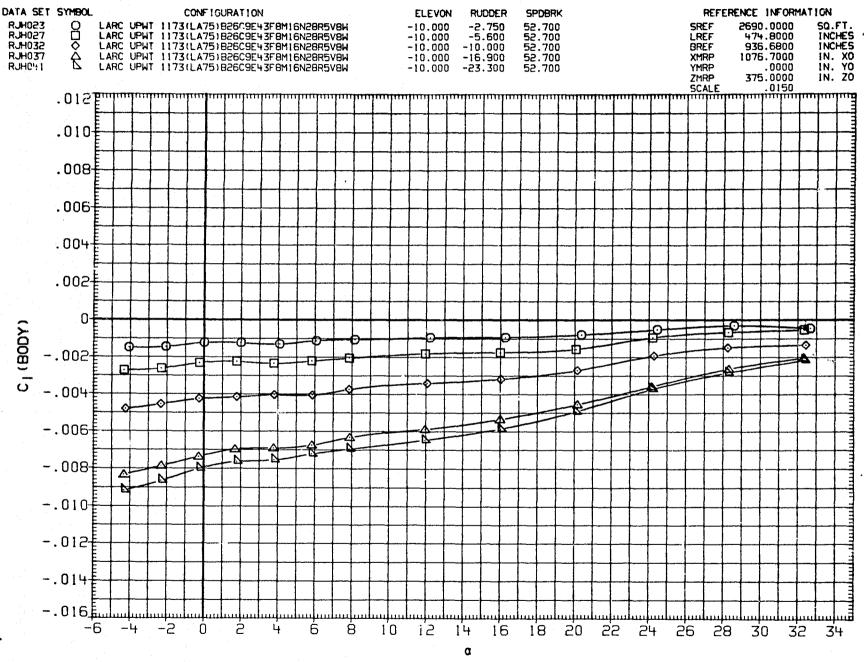


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

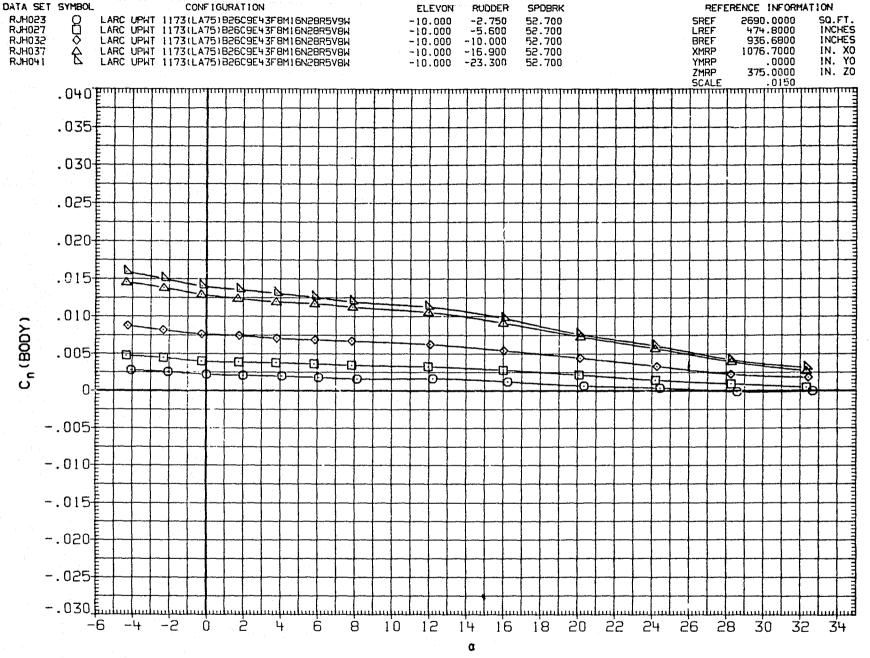


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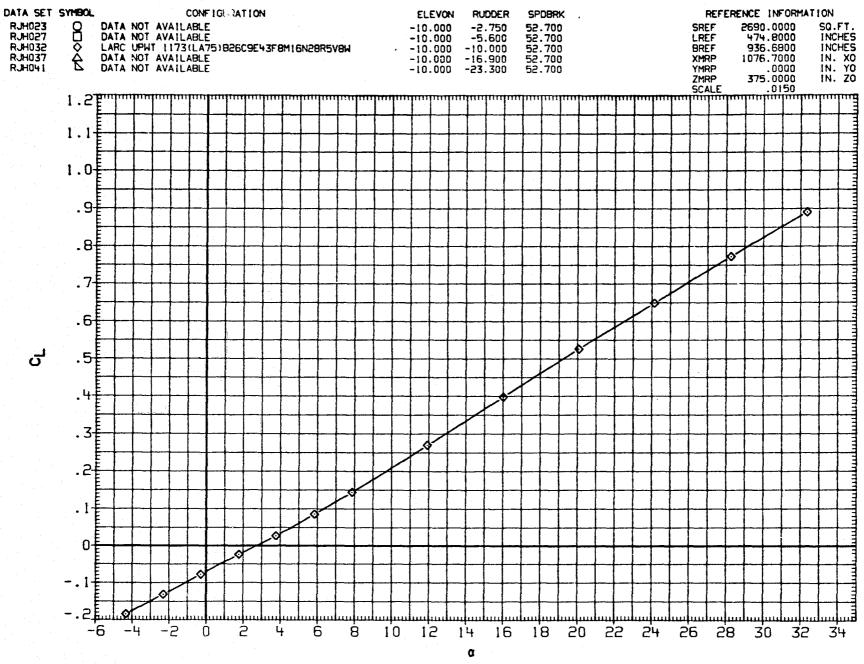


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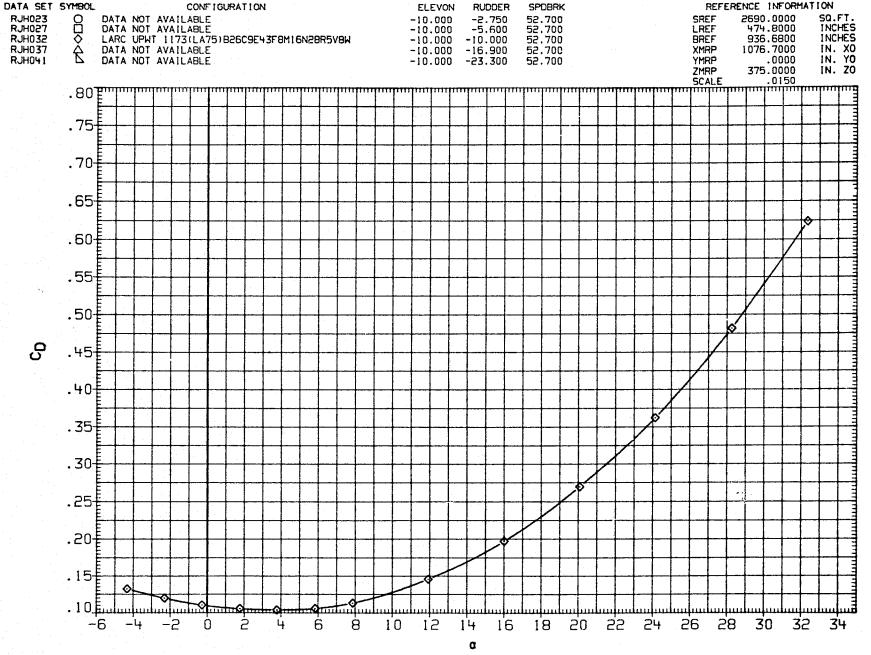


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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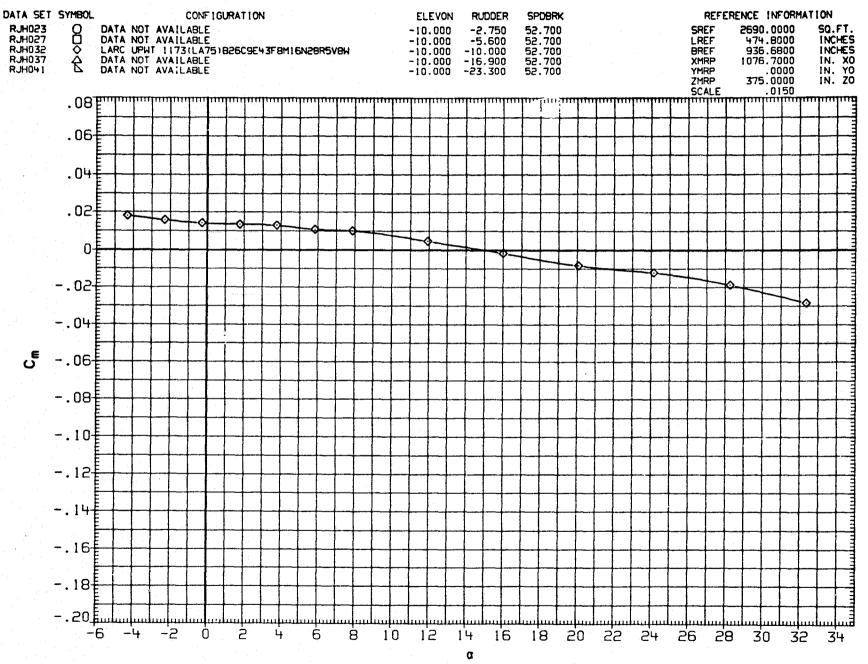


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

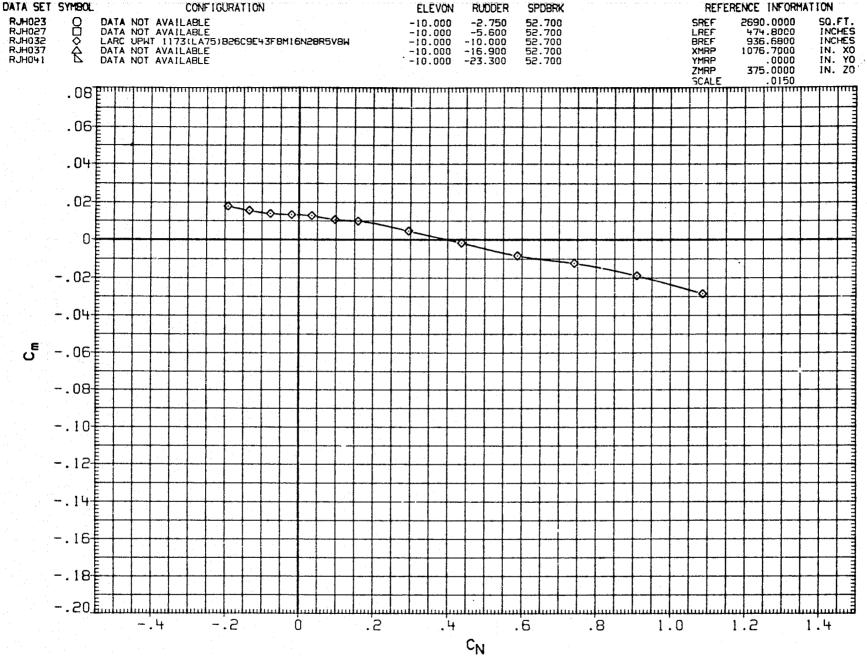


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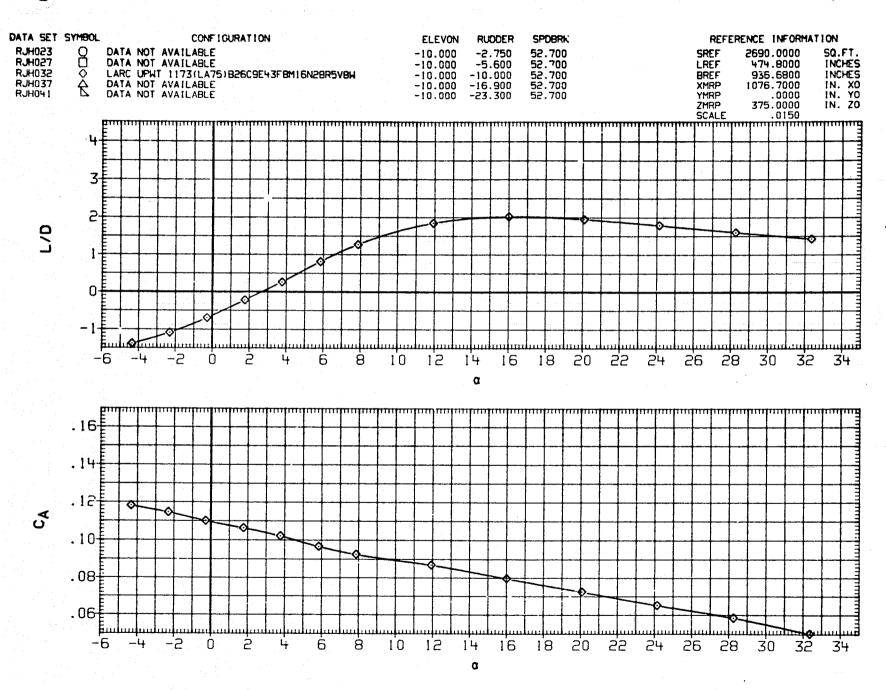


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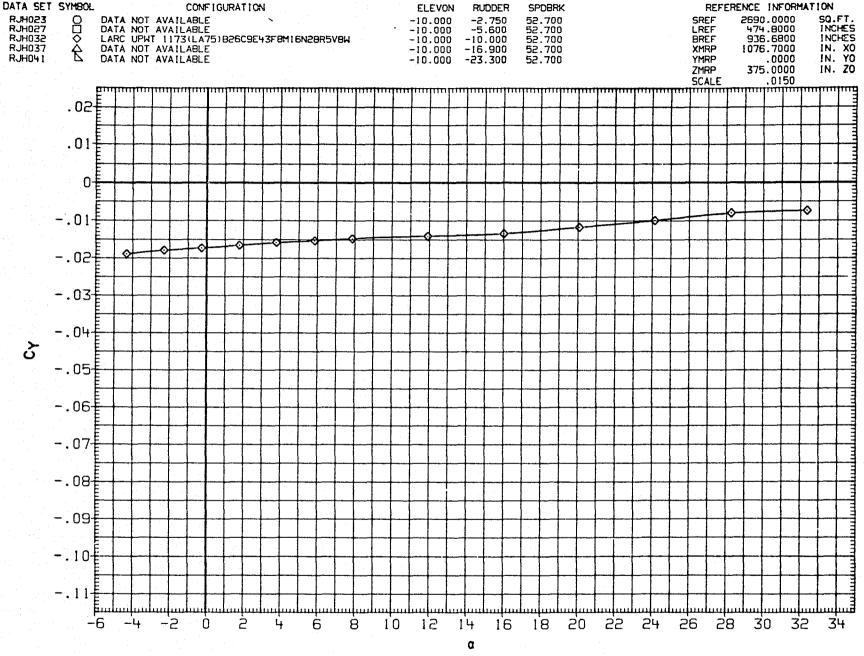


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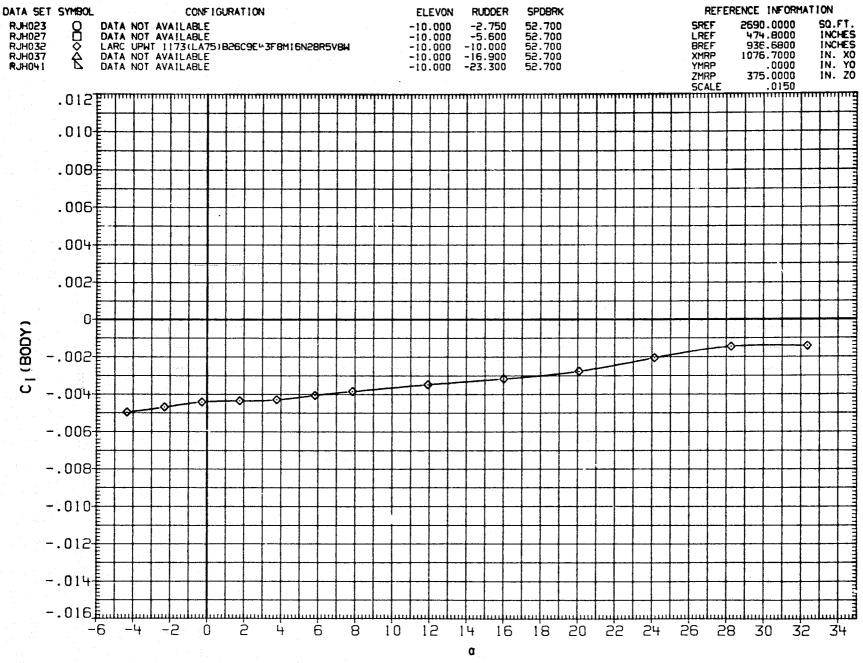


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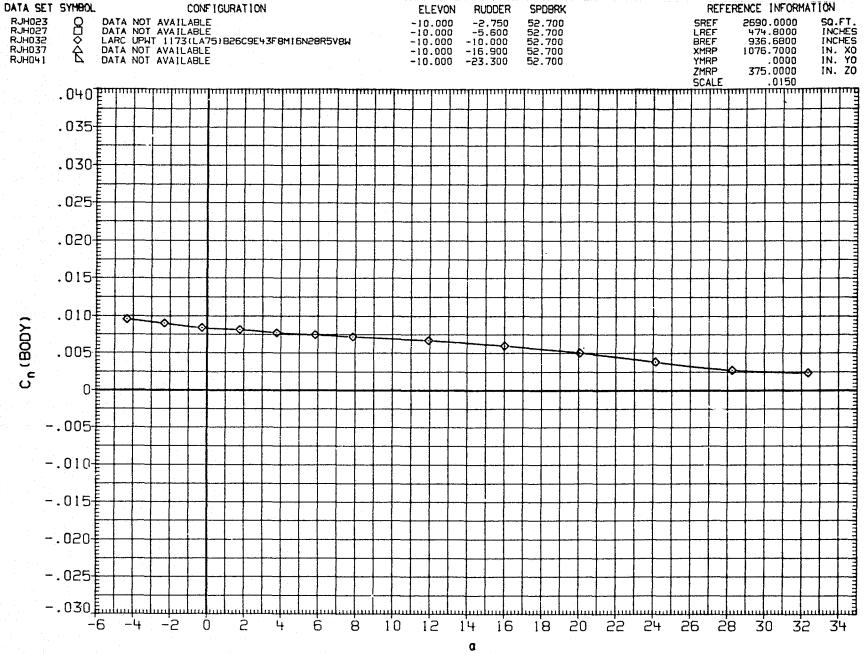


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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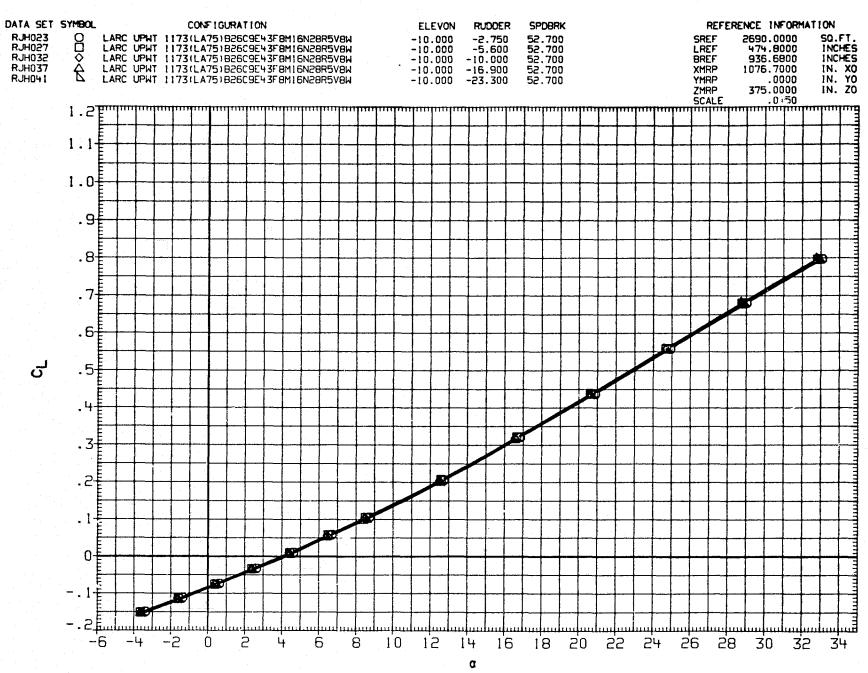


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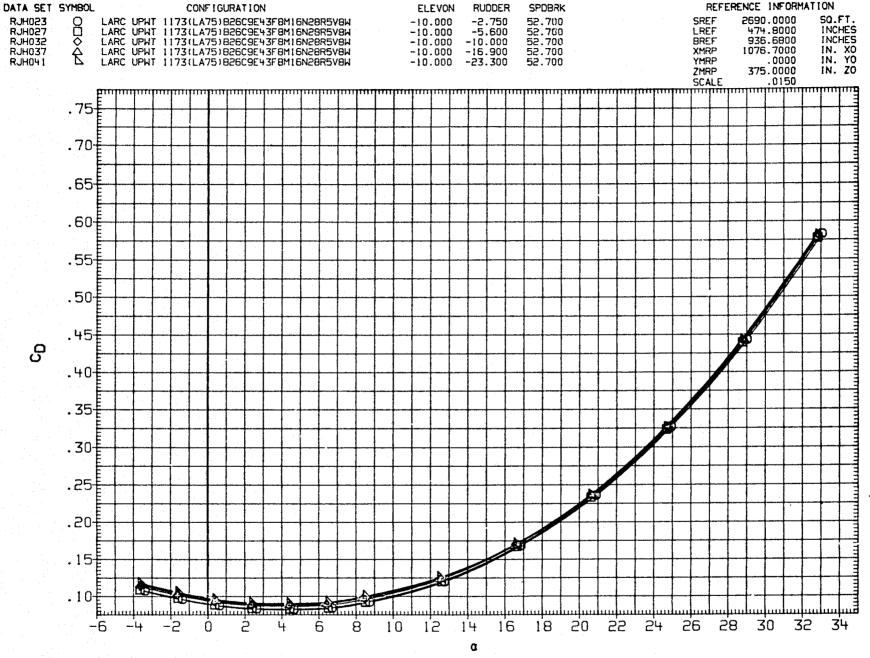


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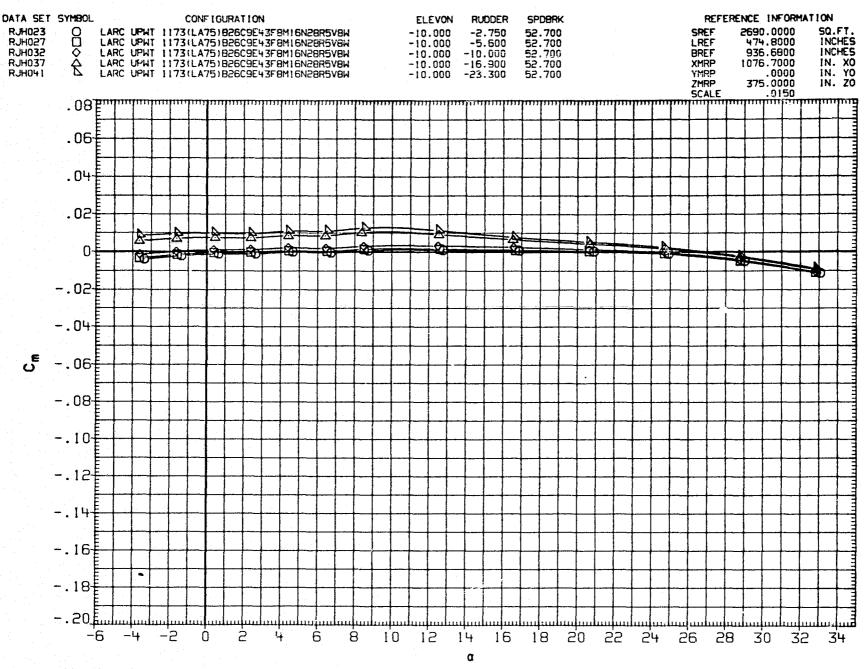


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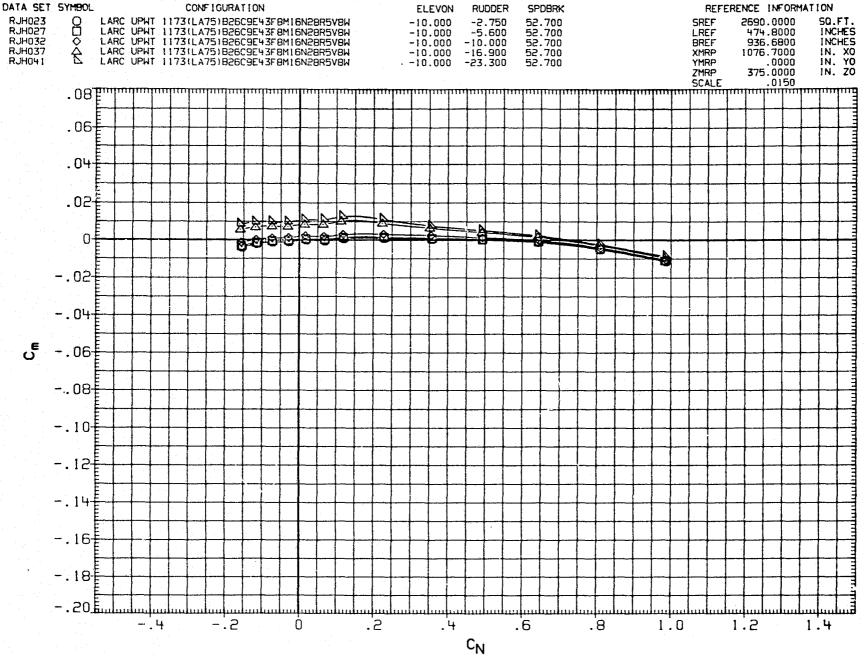


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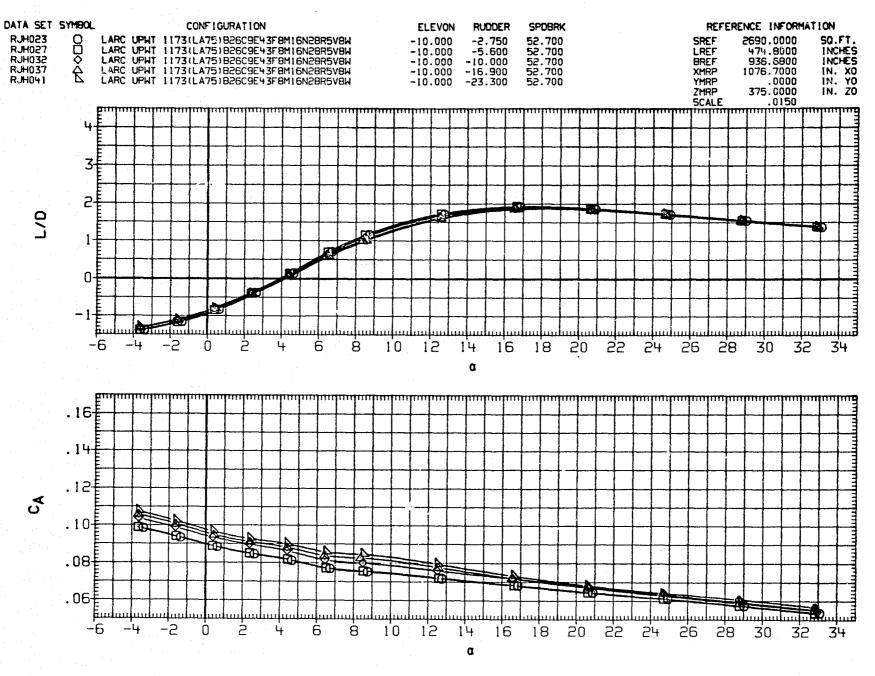


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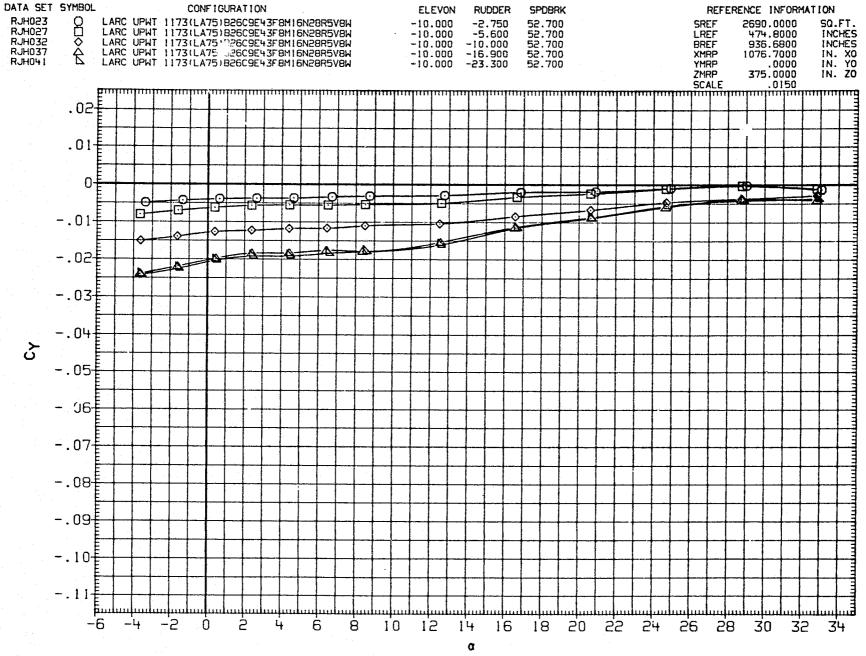


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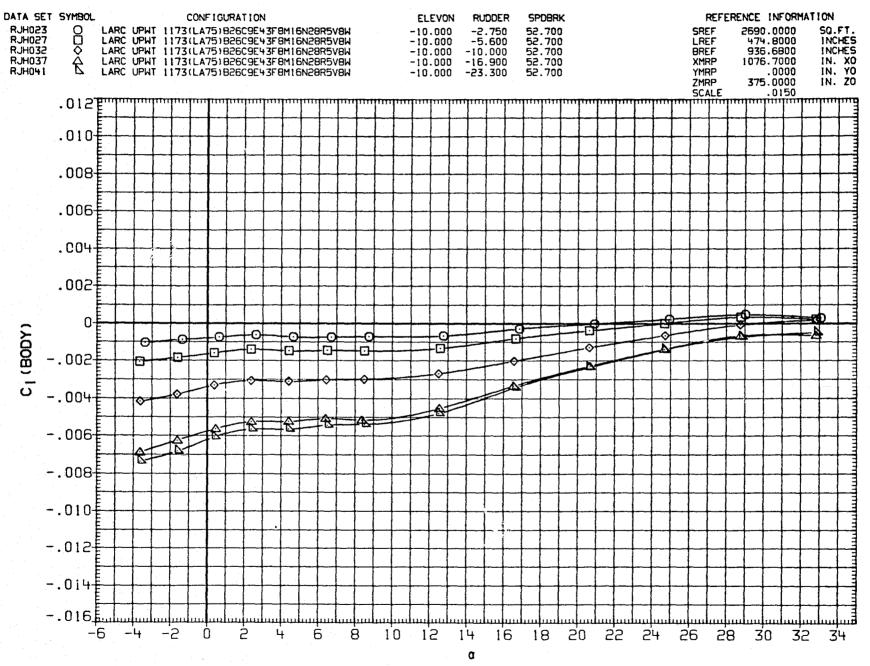


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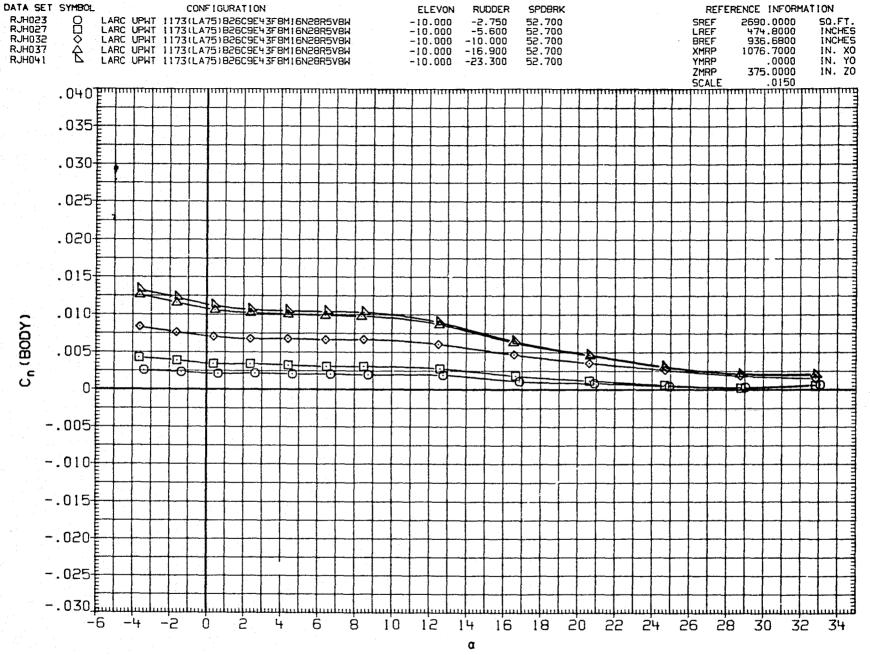


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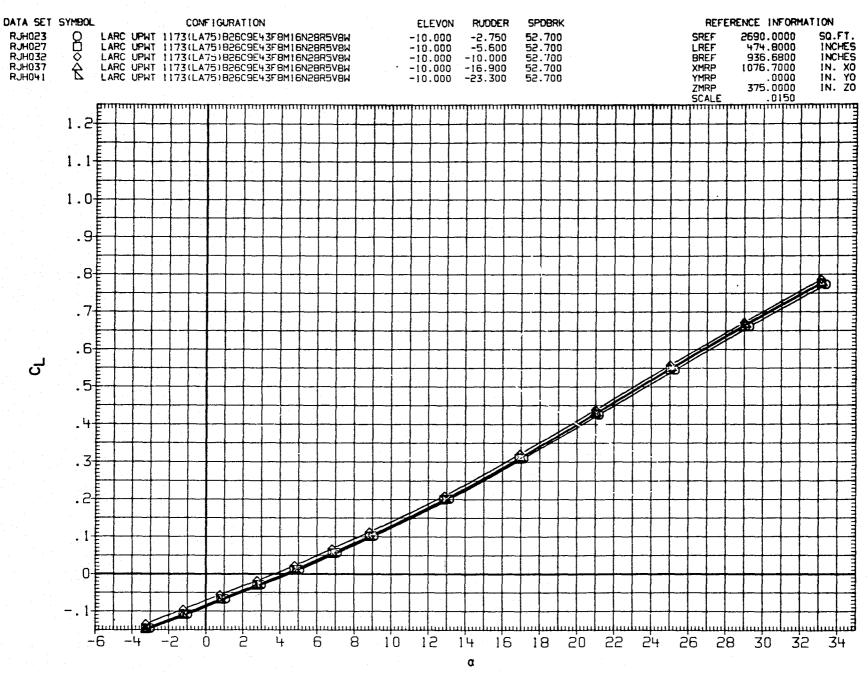


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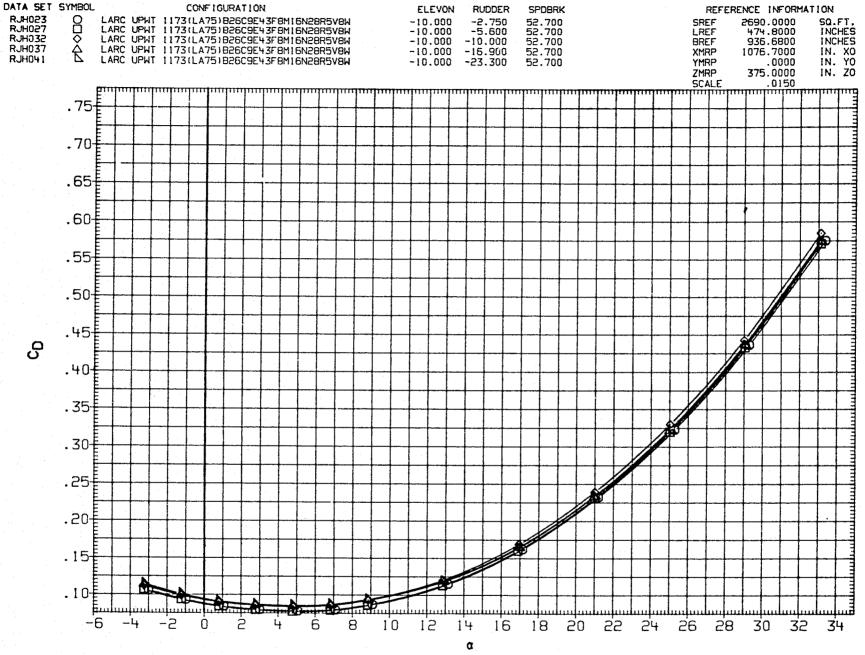


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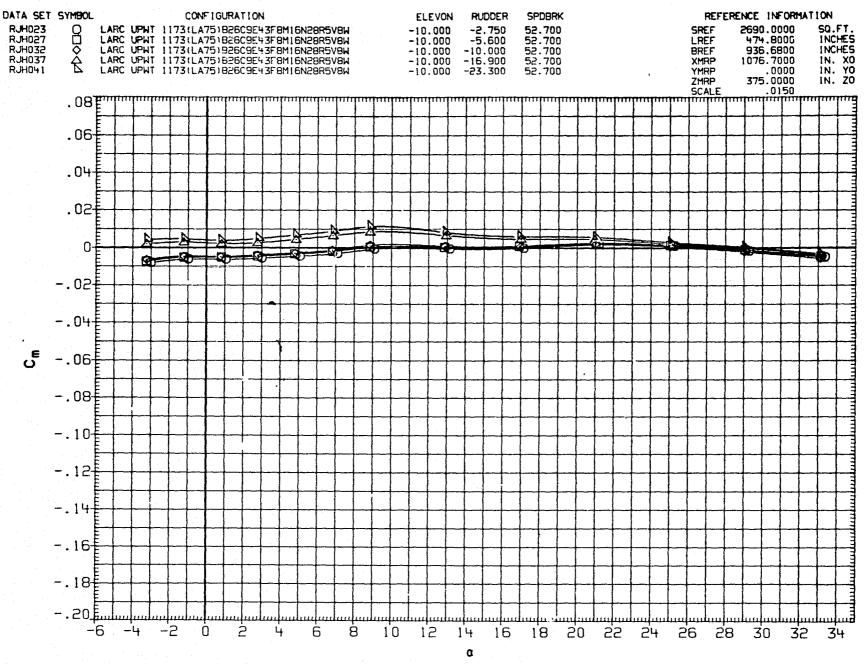


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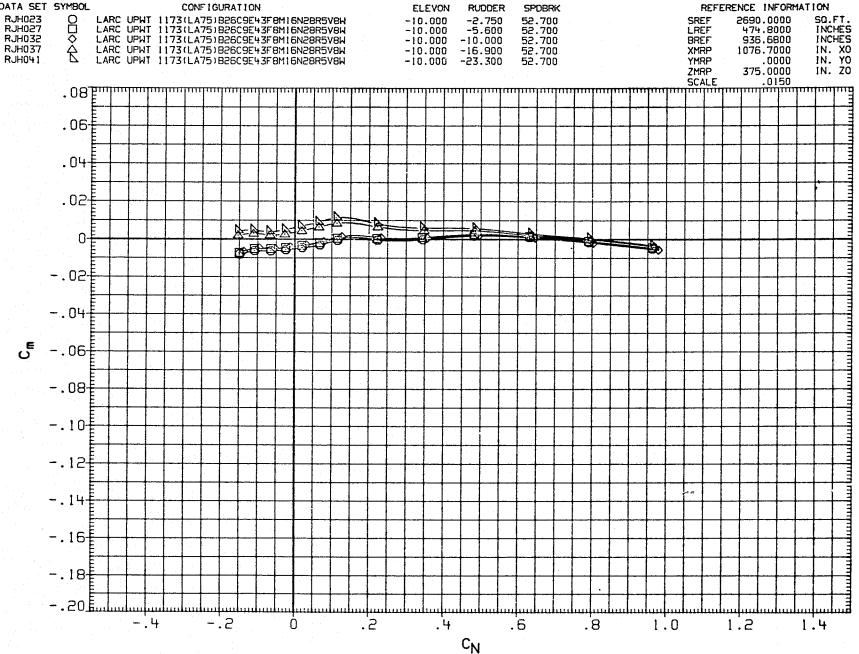


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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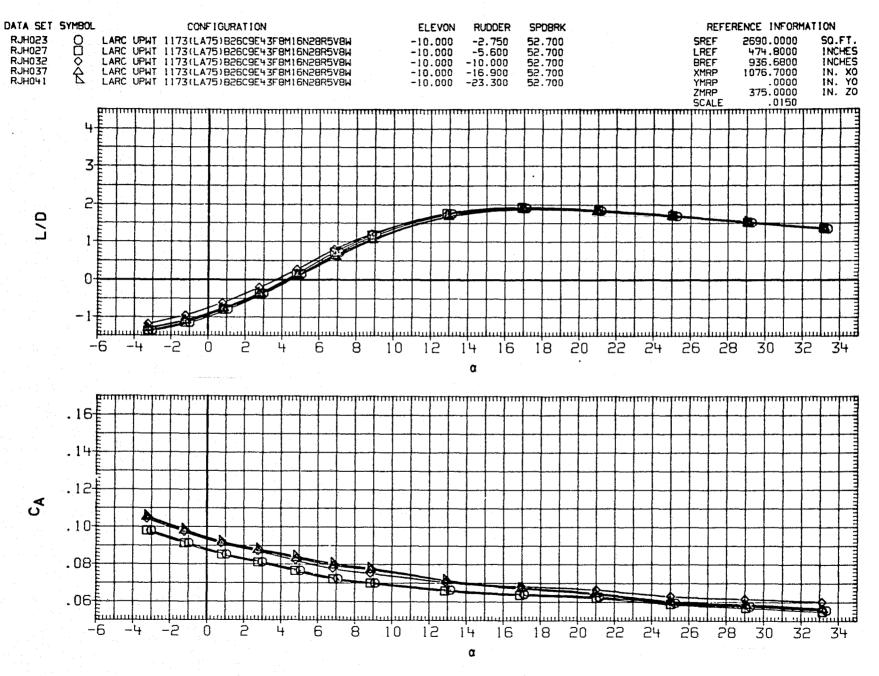


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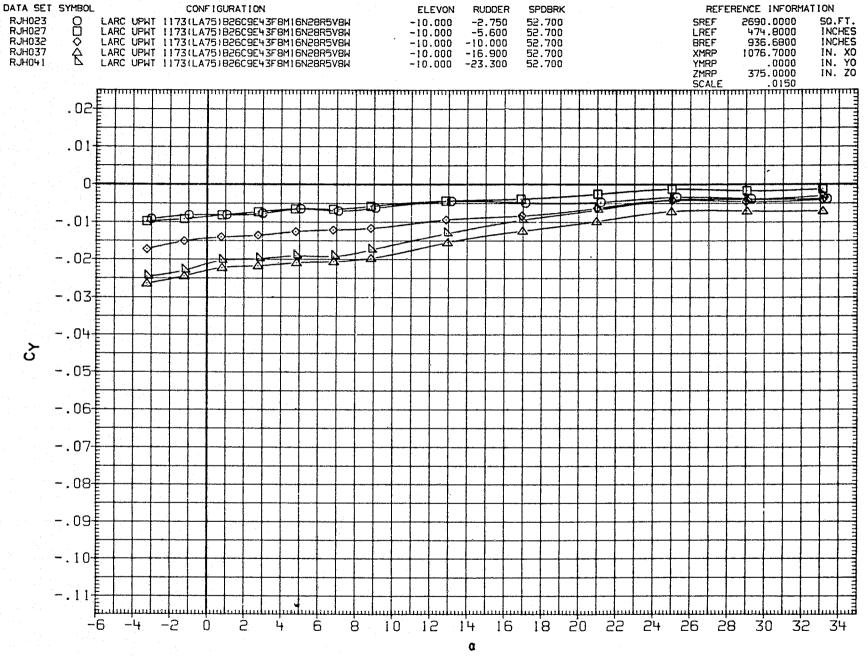


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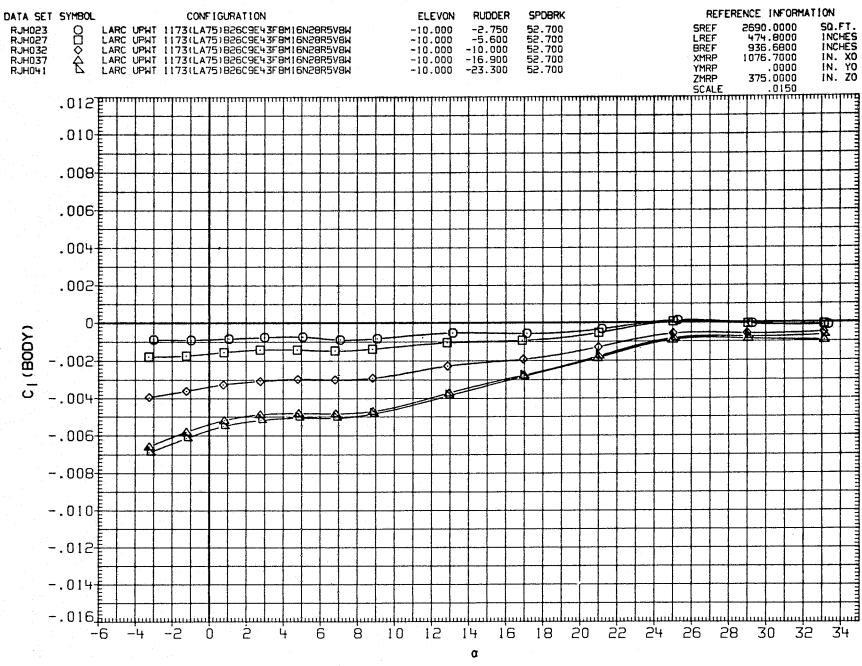


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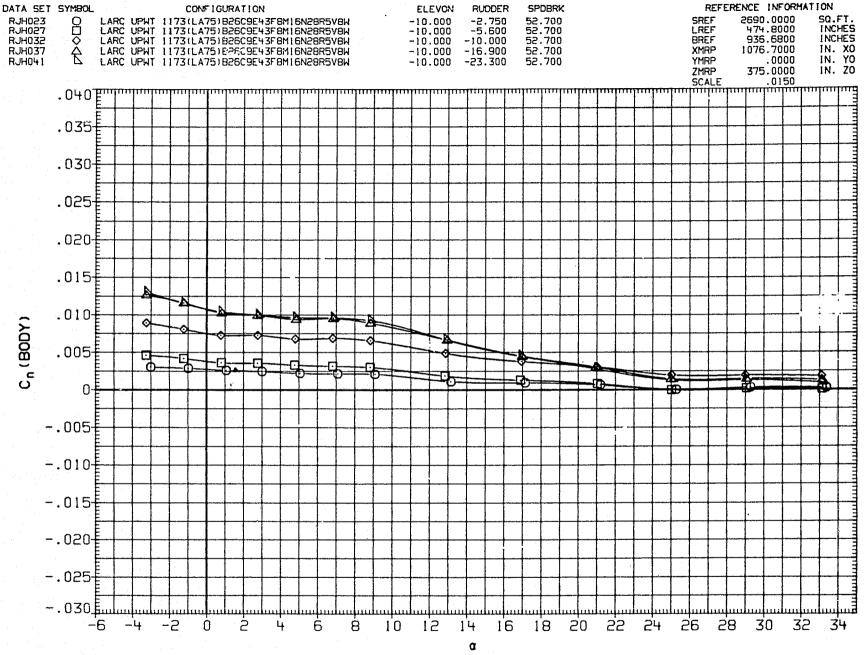


FIGURE 6. RUDDER LINEARITY WITH ELEVON AT -10 DEG., SPEED BRAKE AT 52.7 DEG.

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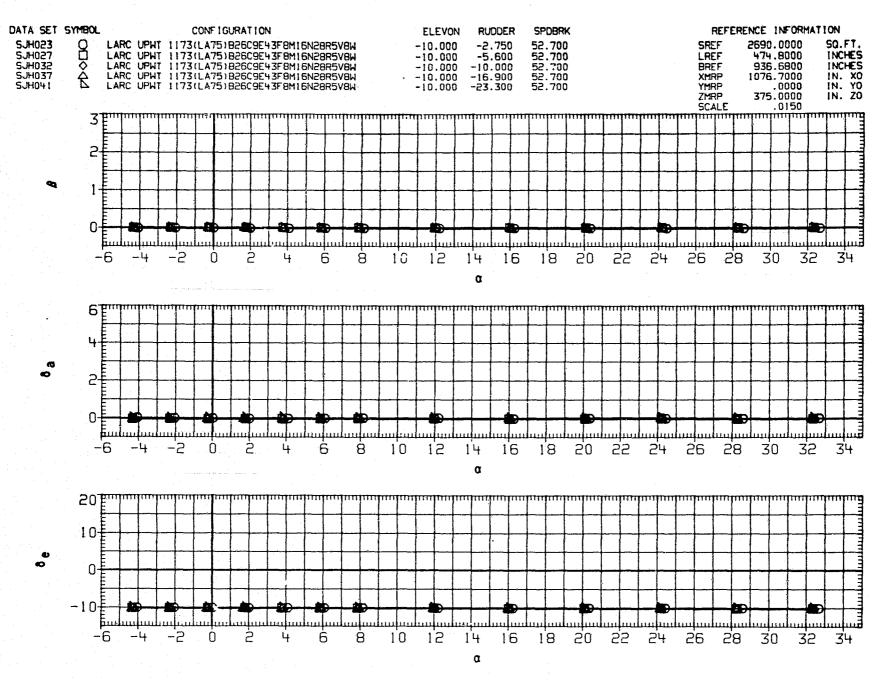


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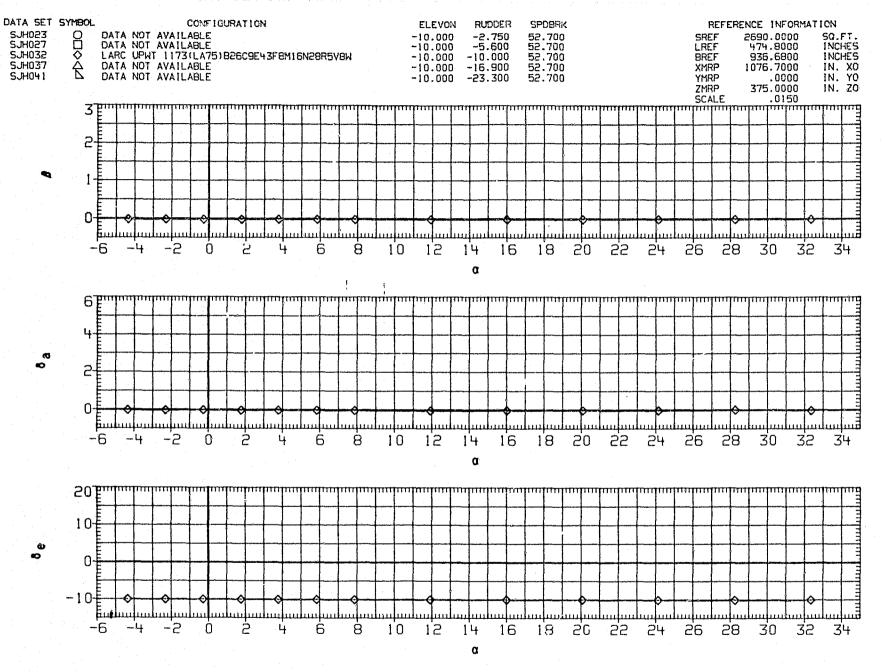


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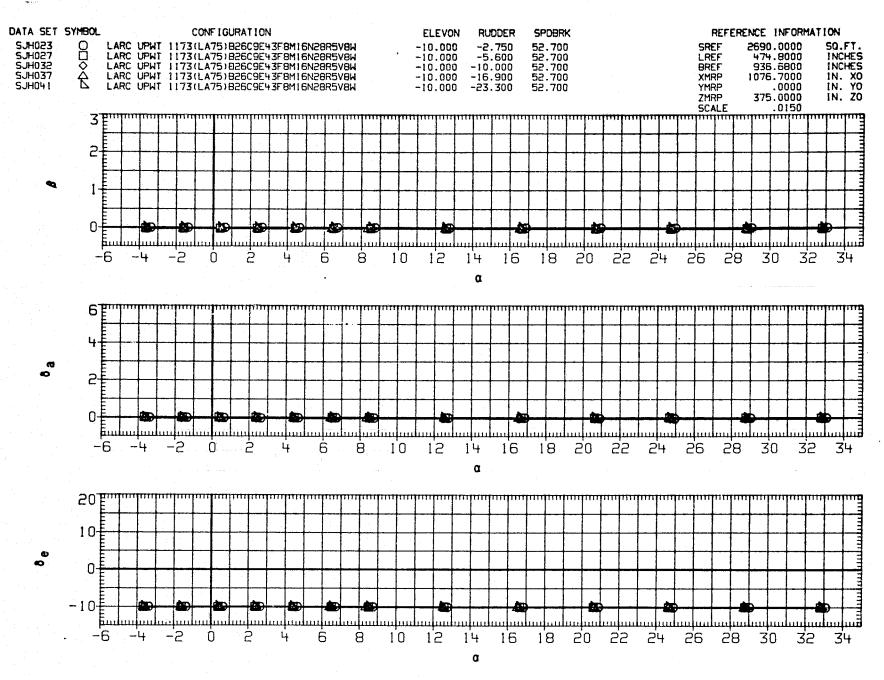


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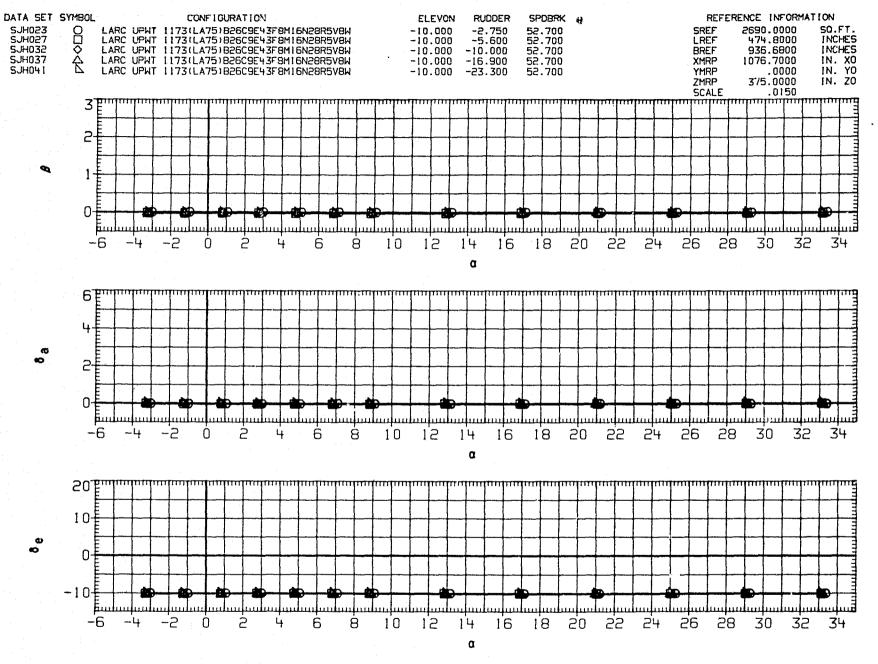


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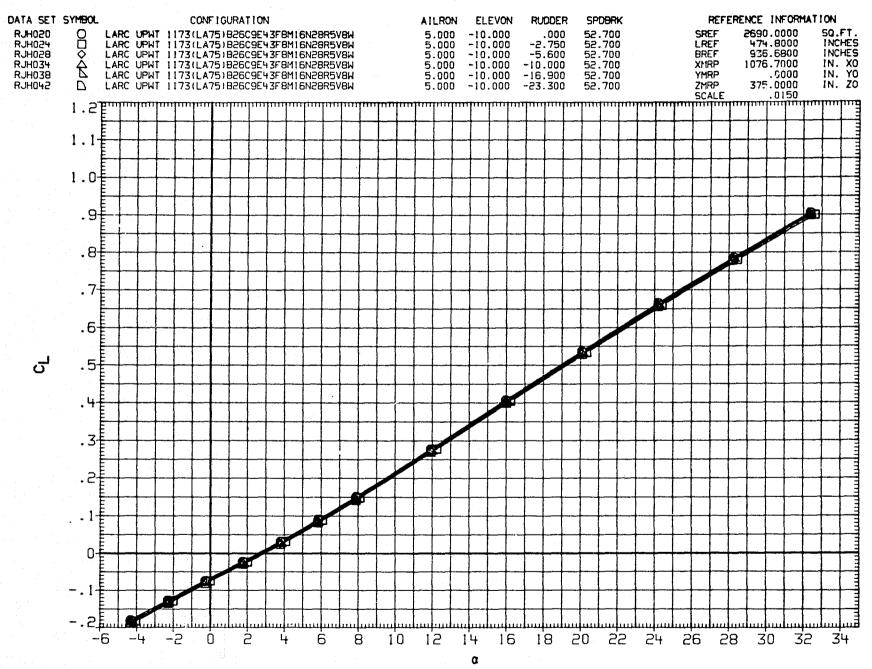
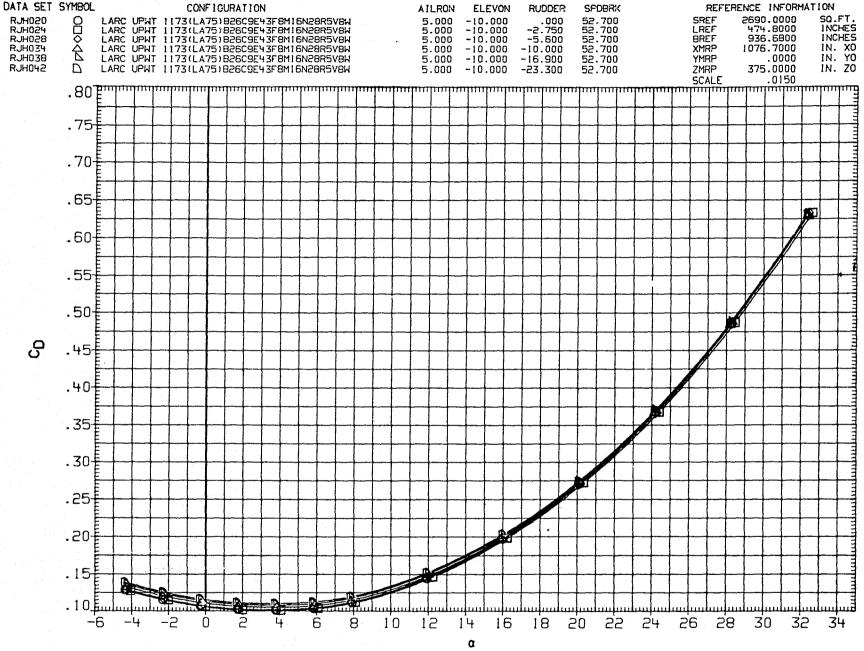


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.



7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG. (A) MACH 2.86 PAGE

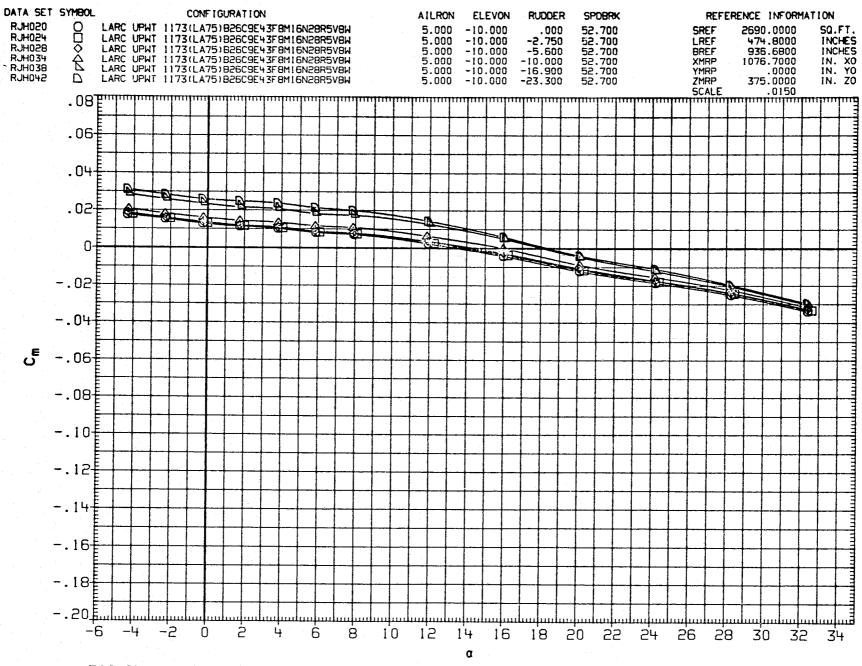


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

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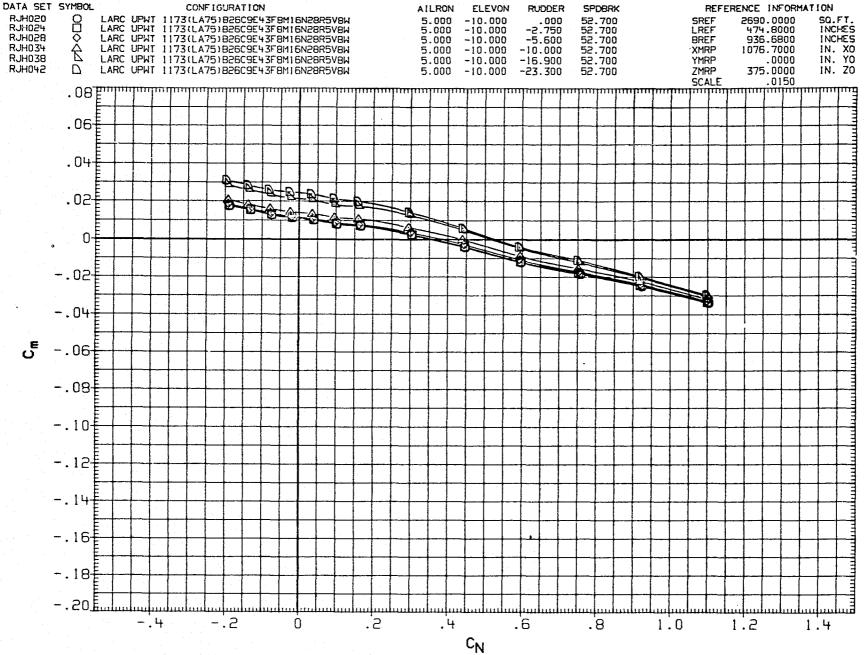


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(A) MACH = 2.86

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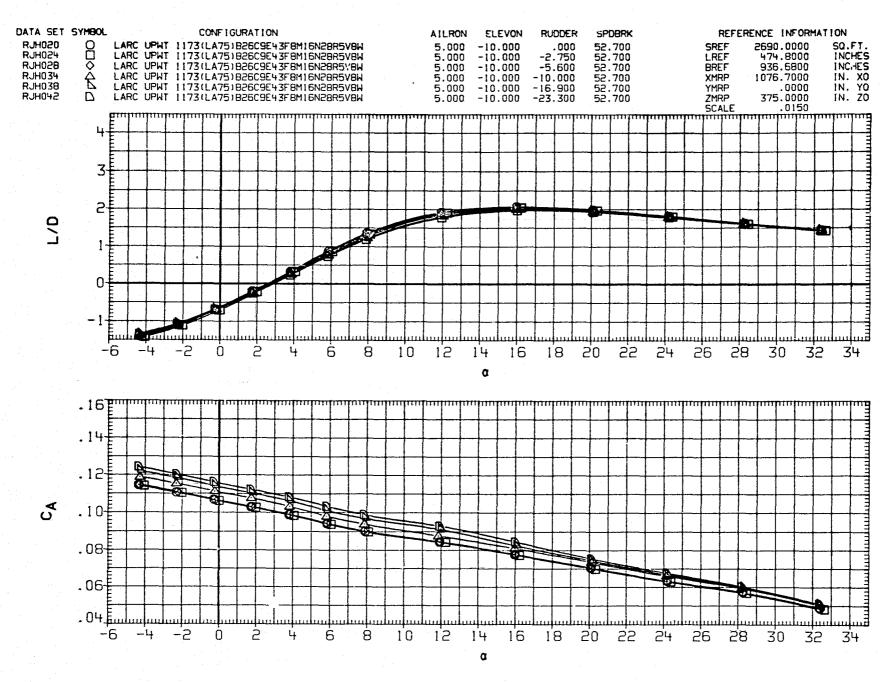
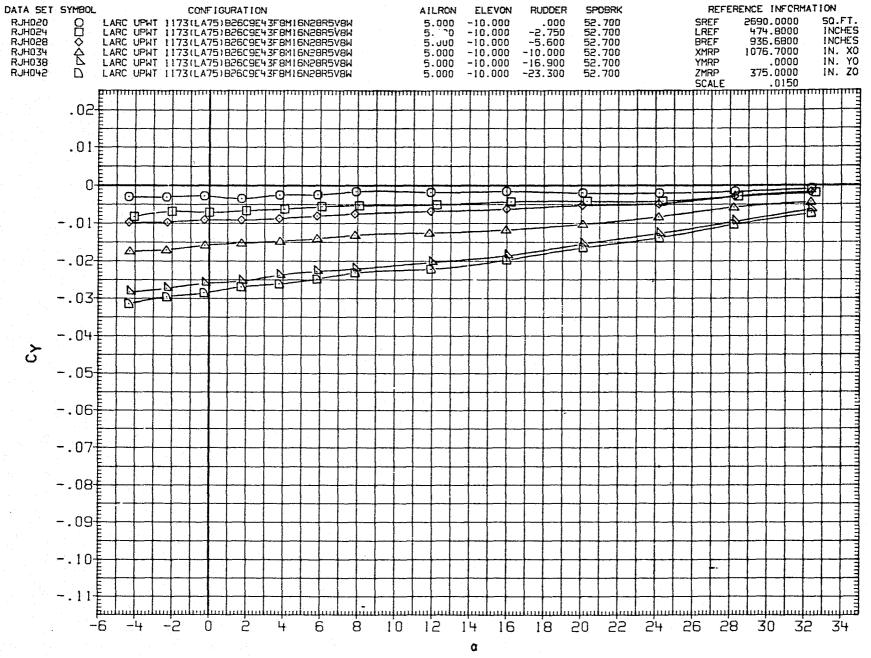
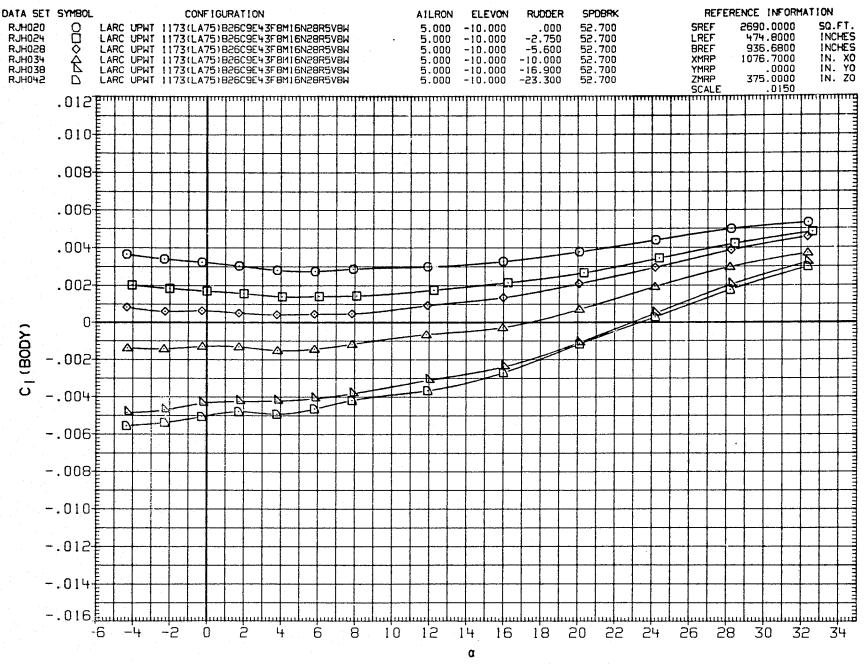


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(A) MACH = 2.86



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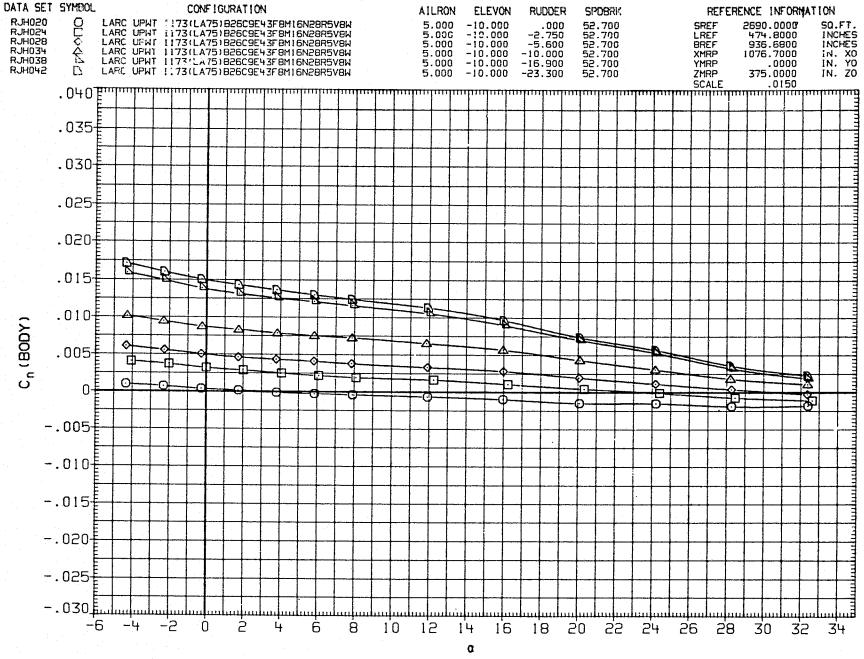


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(A) MACH = 2.86

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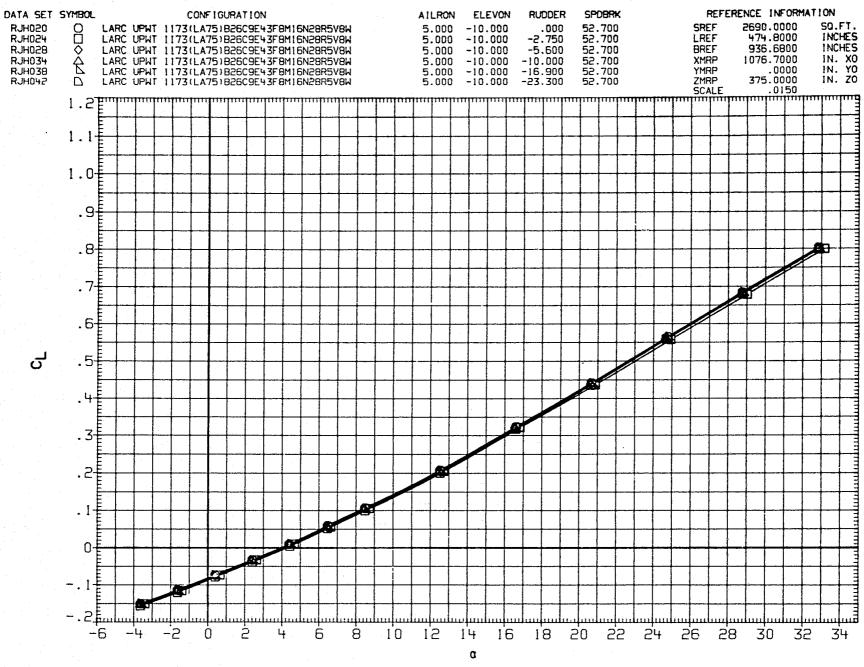


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

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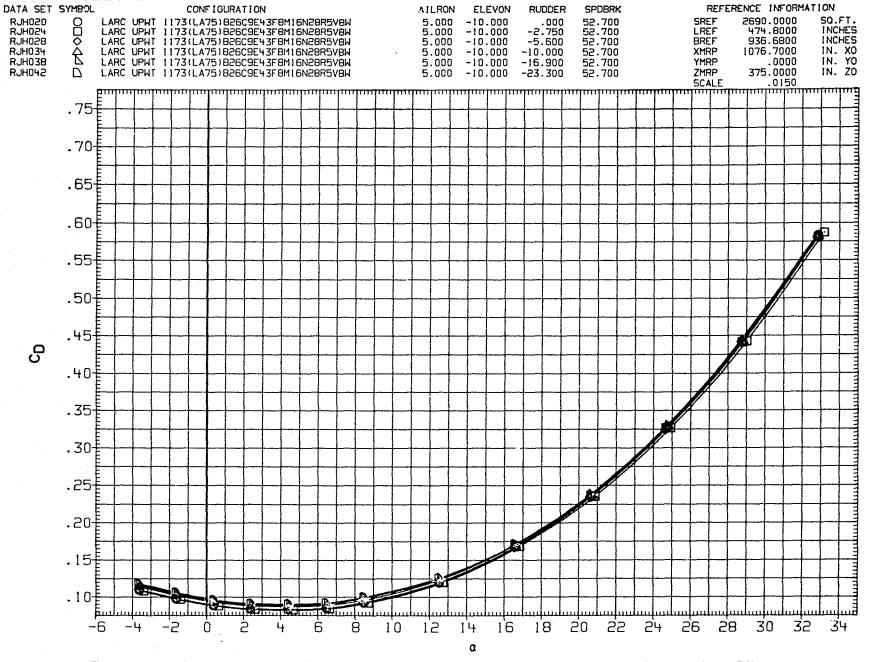


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(B) MACH = 3.90

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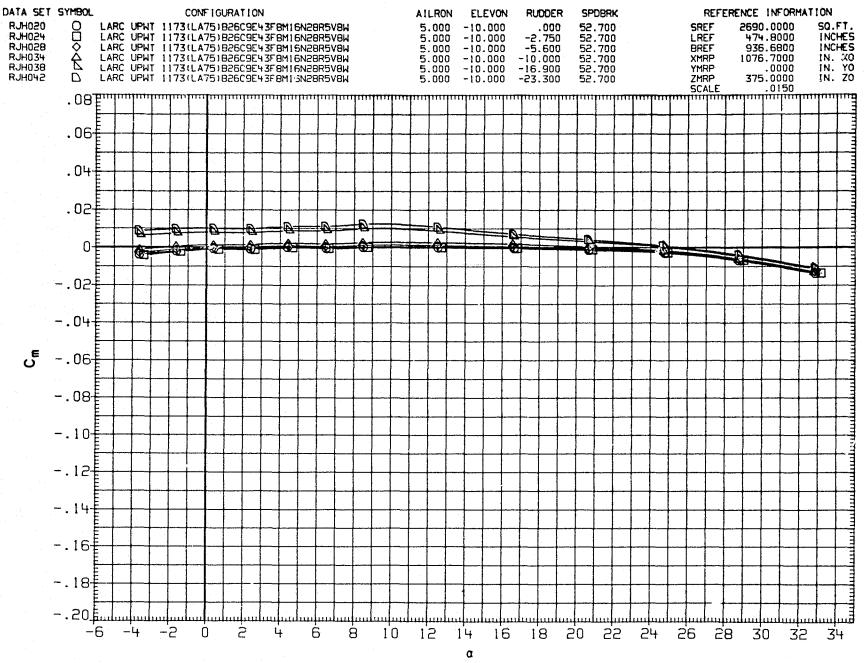


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(B)MACH = 3.90

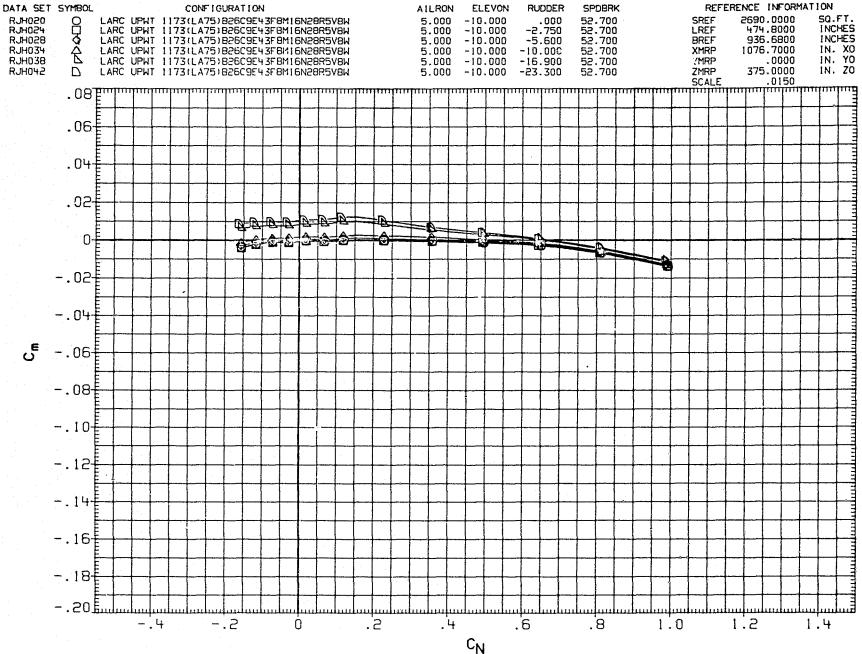


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(B)MACH = 3.90

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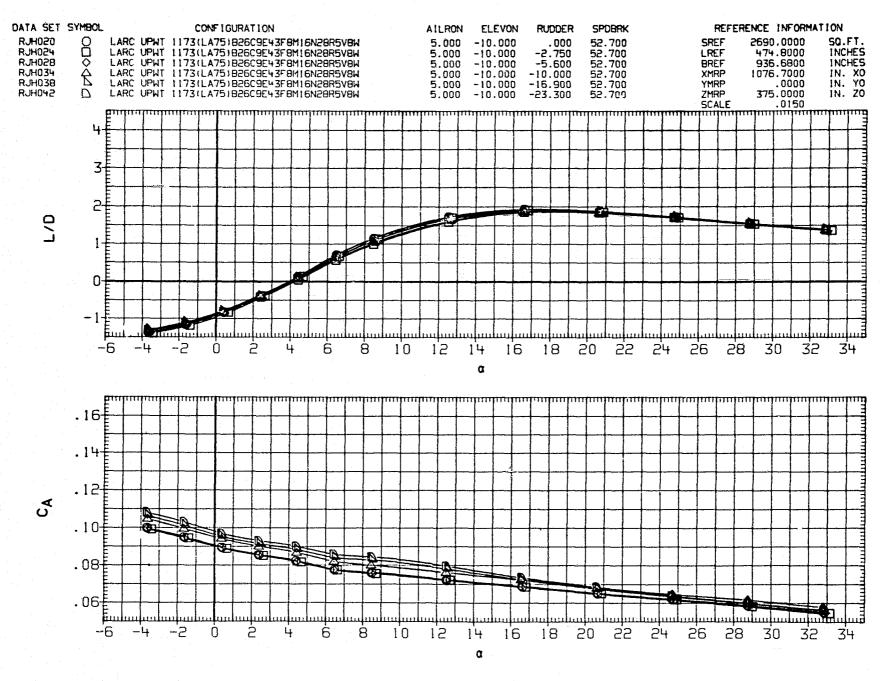


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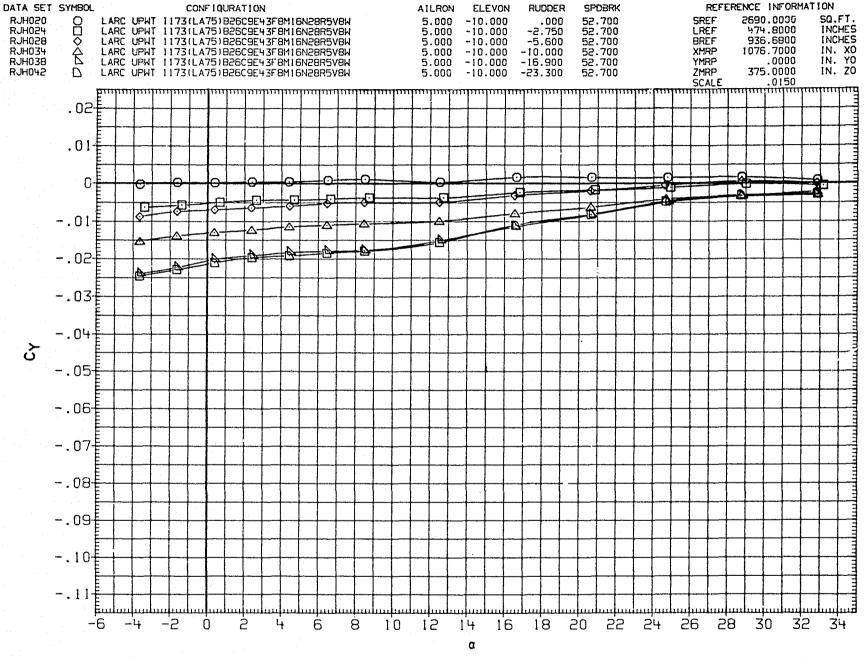


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(B) MACH = 3.90

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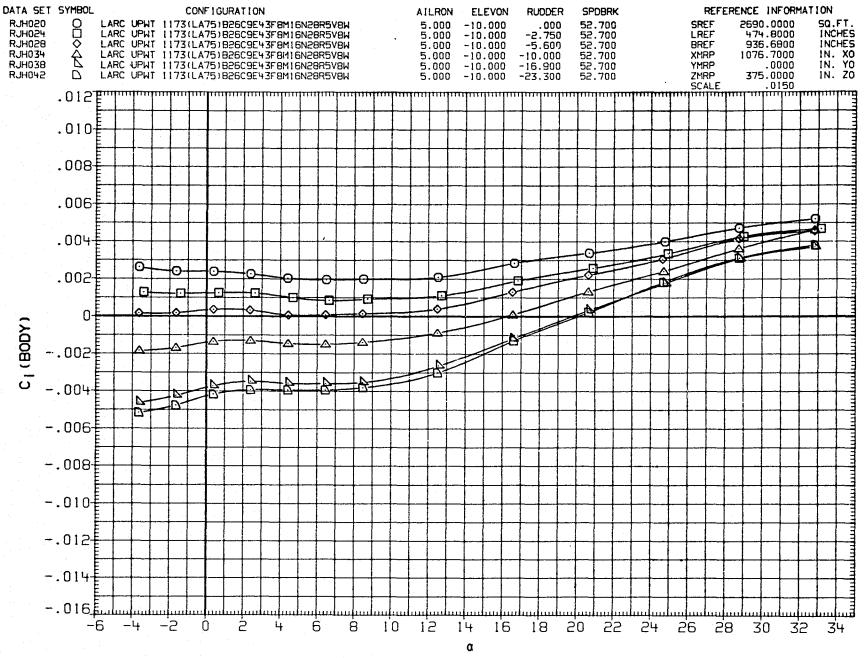


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(B) MACH = 3.90 PAGE

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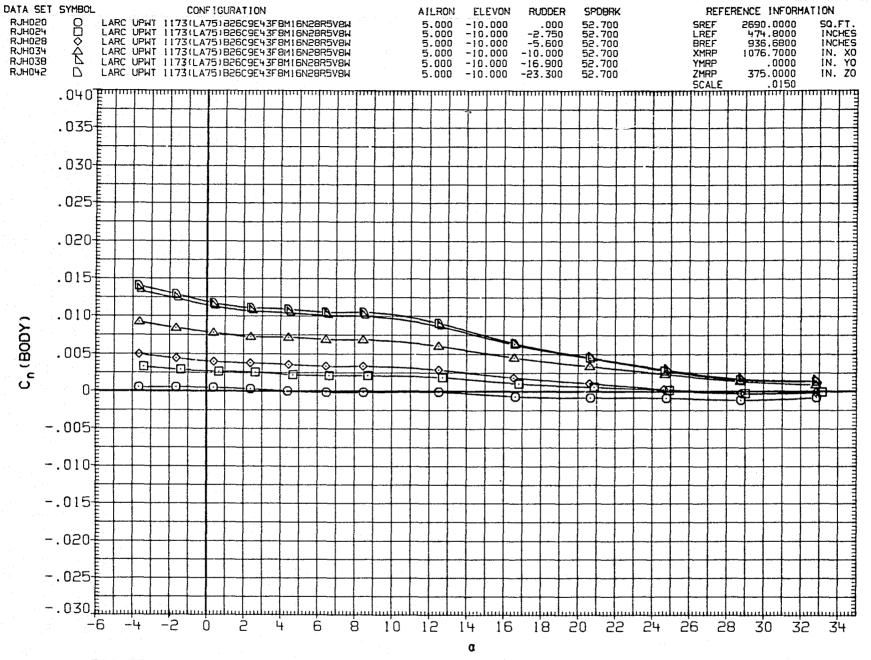


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(B) MACH = 3.90

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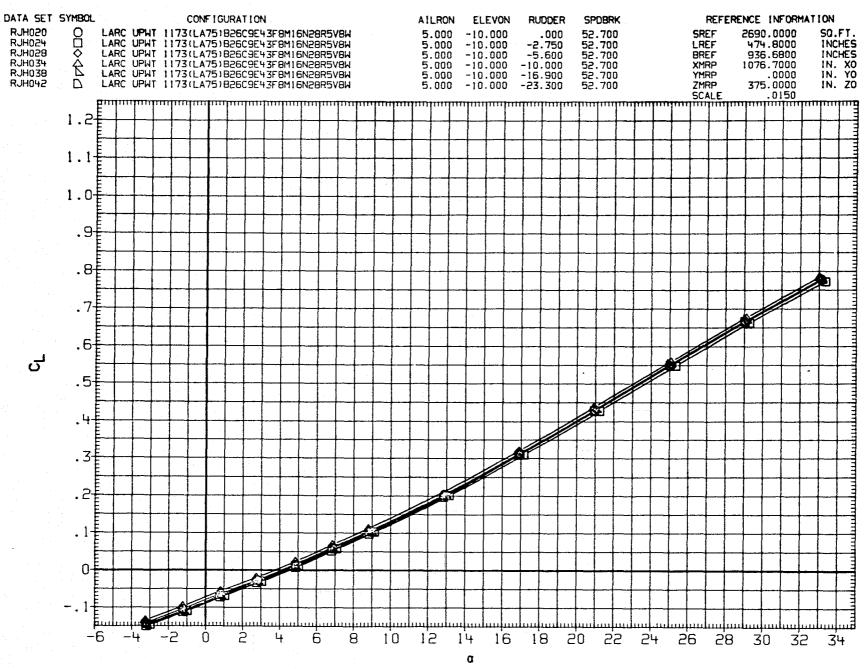


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

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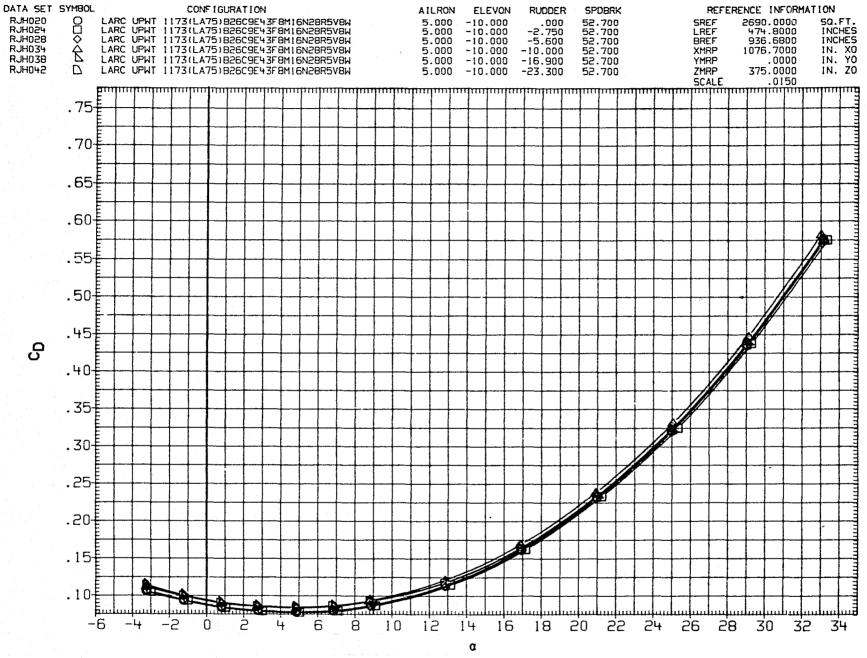


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(C) MACH = 4.60

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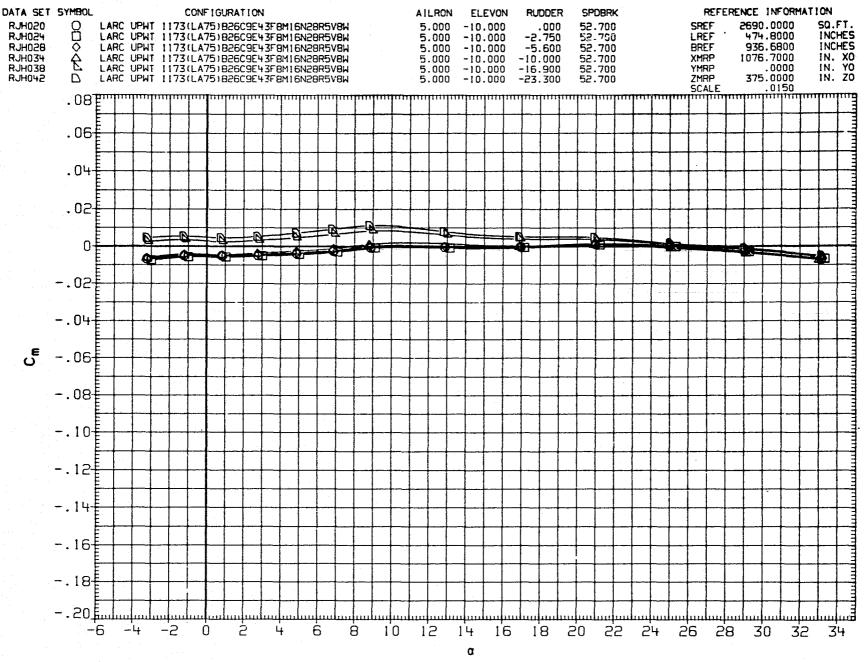


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(C) MACH = 4.60

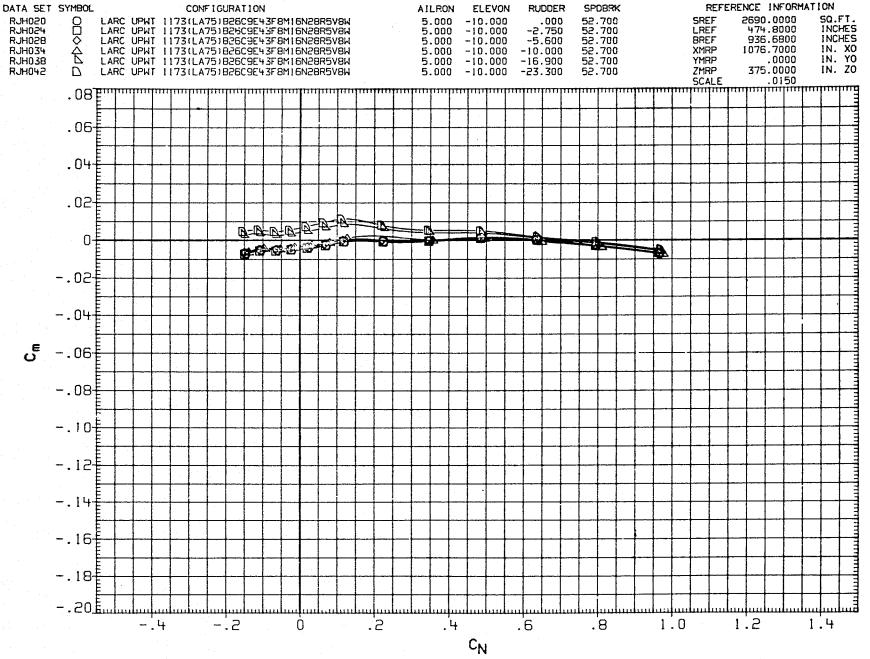


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG.,
SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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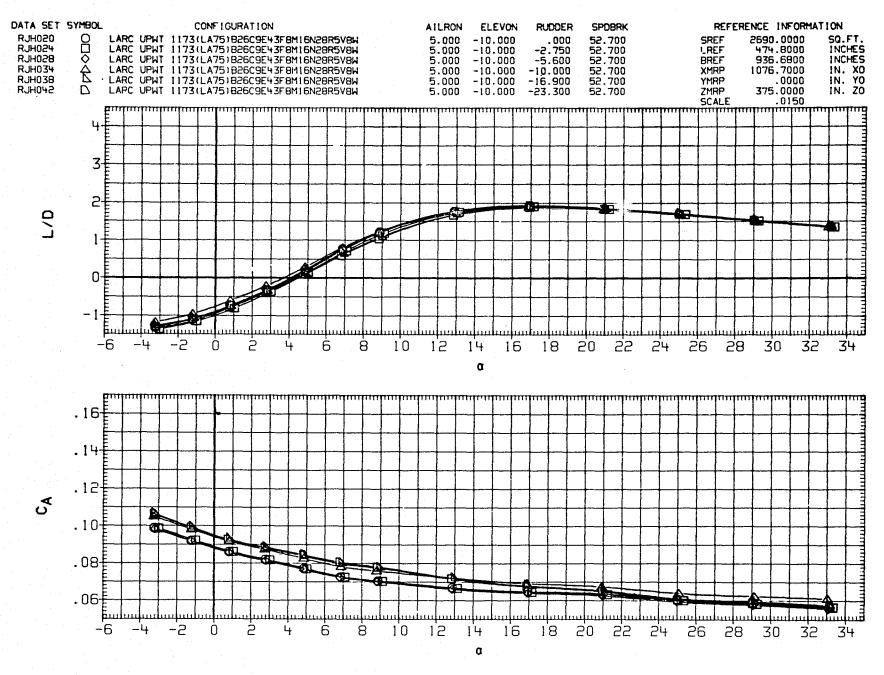


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(C) MACH = 4.60

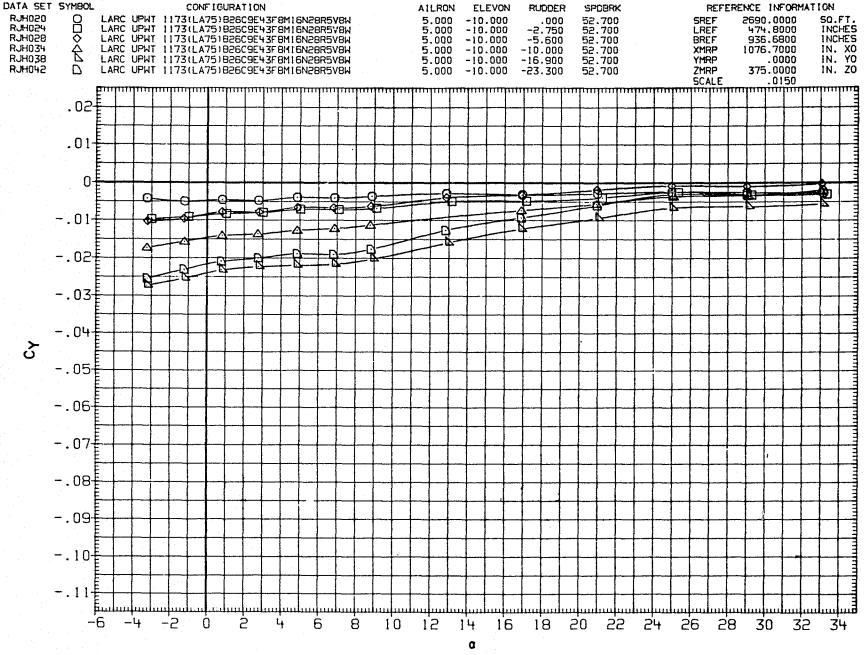


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(C) MACH = 4.60 PAGE

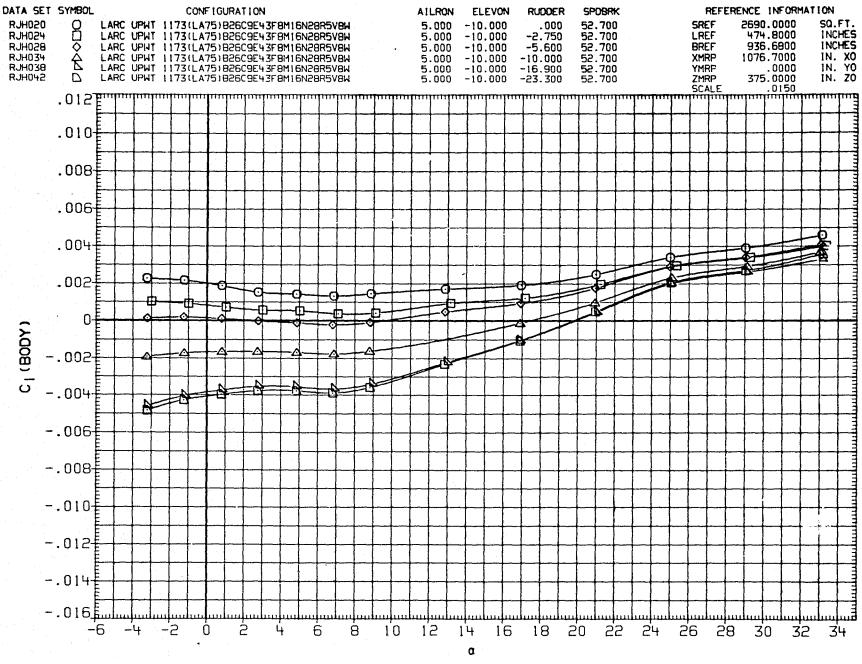


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(C)MACH = 4.60

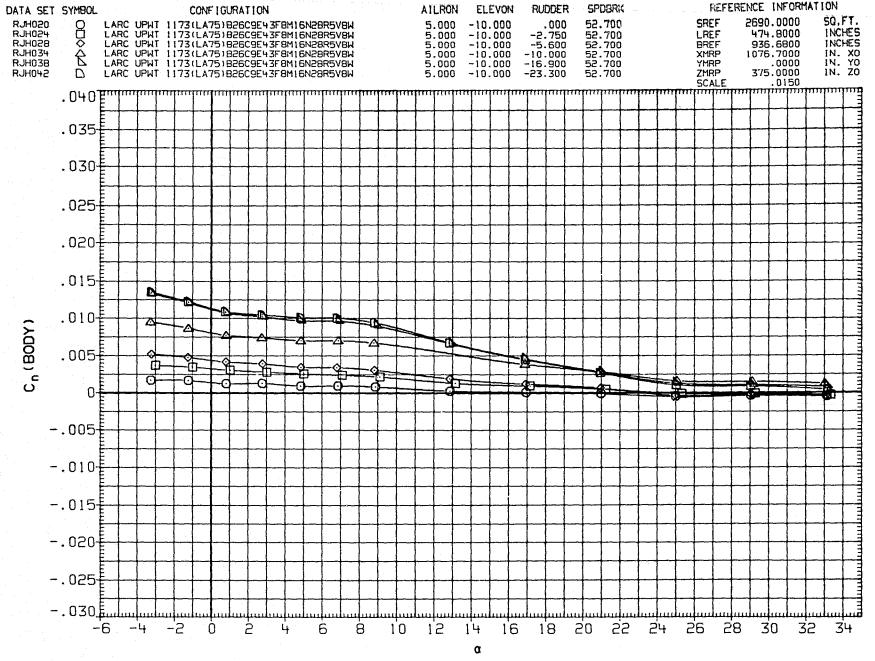


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG.,
SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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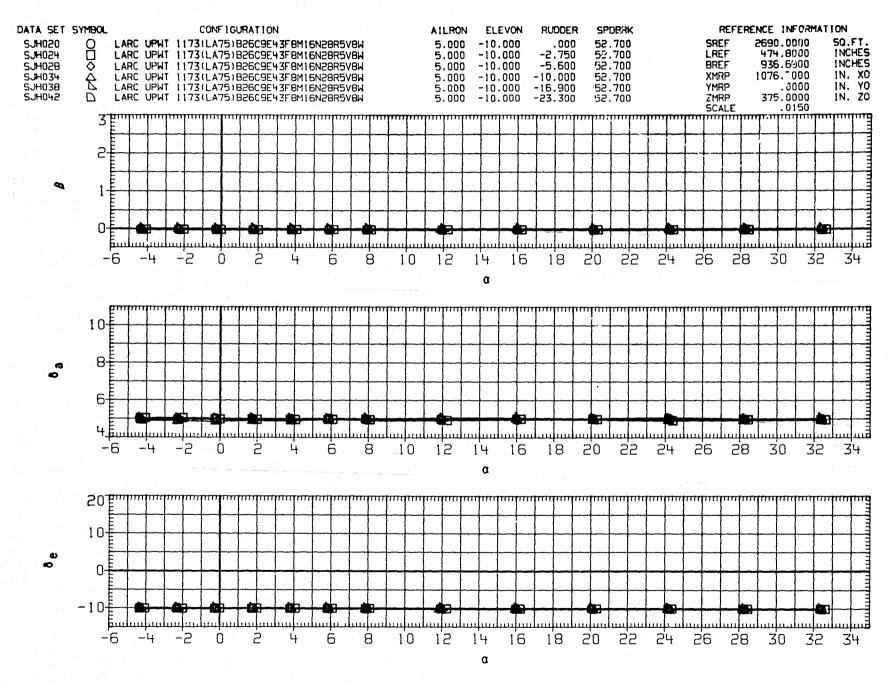


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

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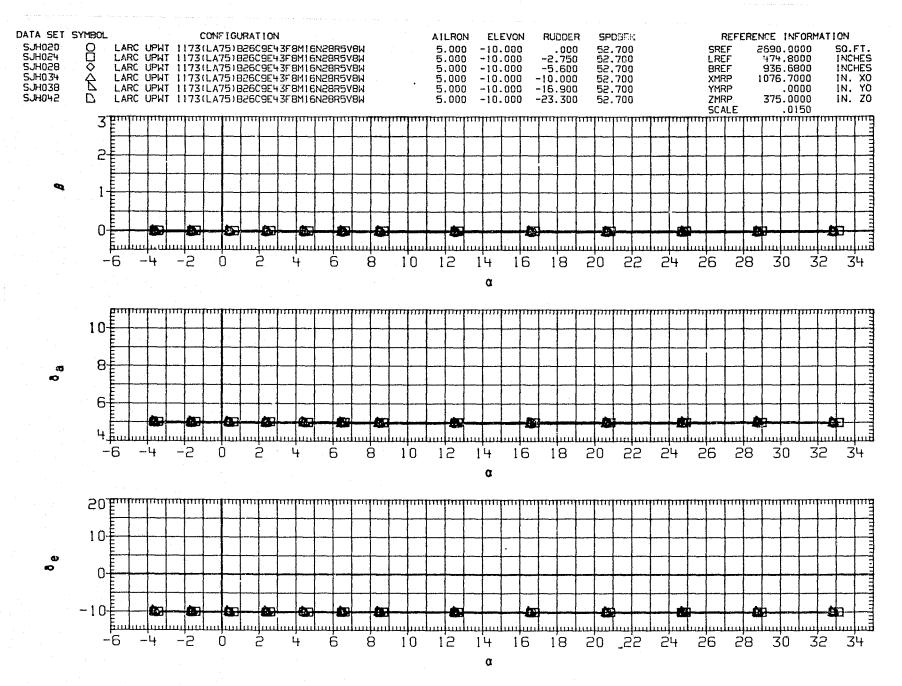
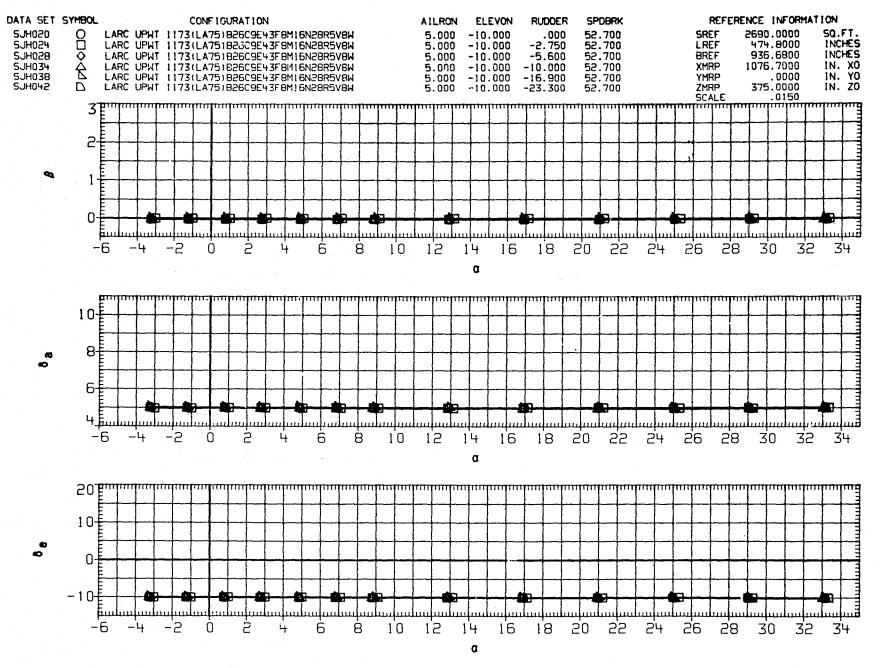


FIGURE 7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG. PAGE

(B) MACH

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7. RUDDER LINEARITY WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG. (C)MACH = 4.60

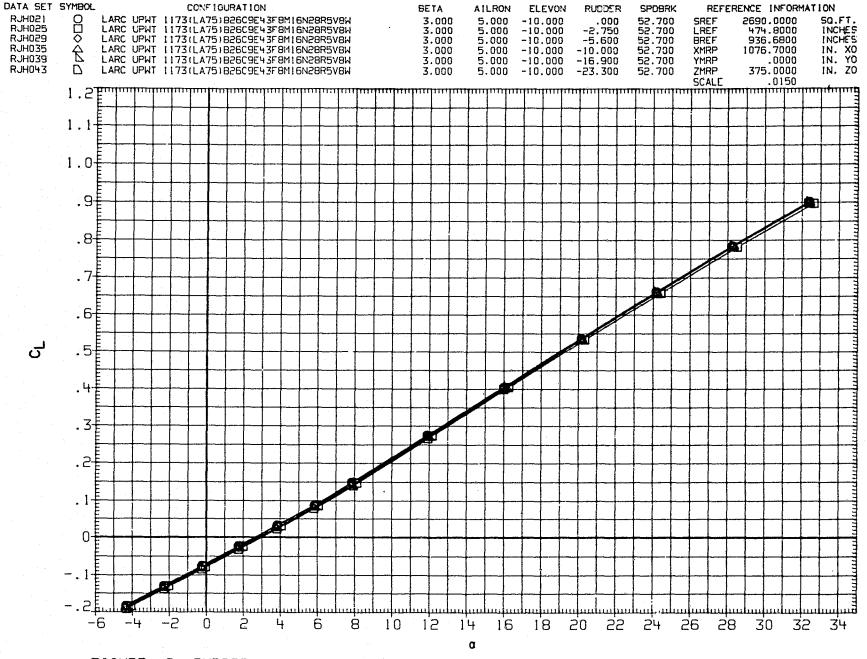


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

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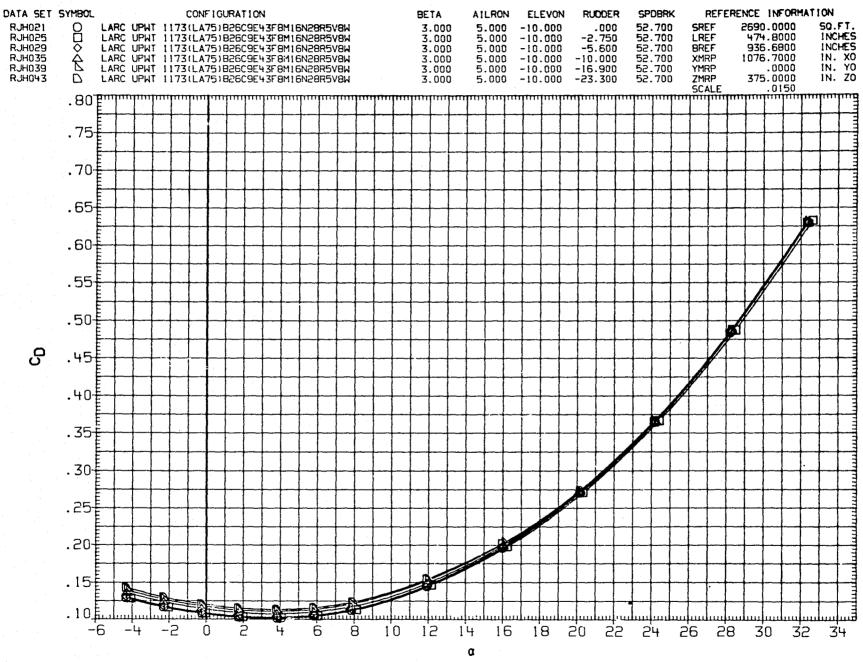


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(A) MACH = 2.86 PAGE

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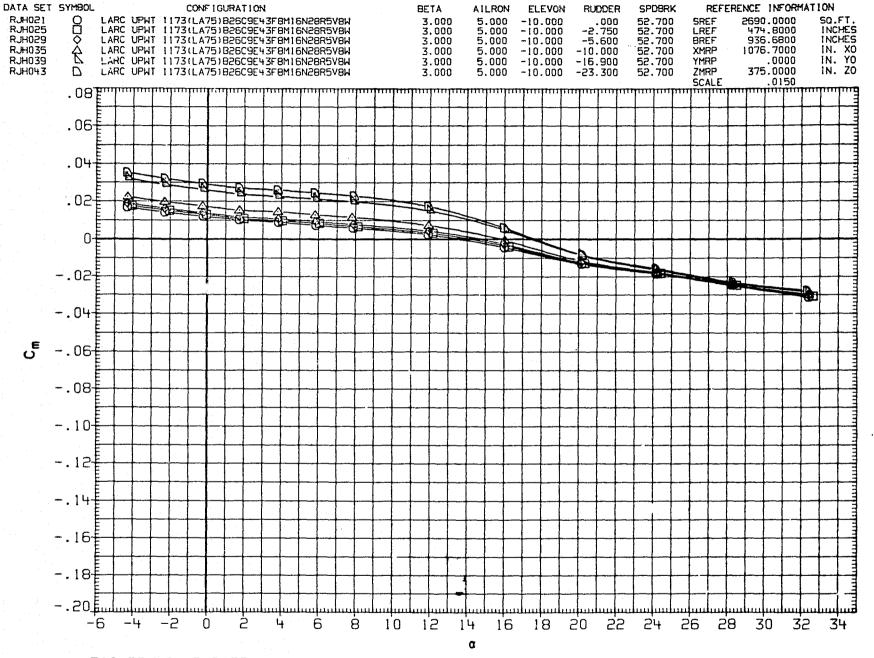


FIGURE 8.-RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND ALLERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86 PAGE 120

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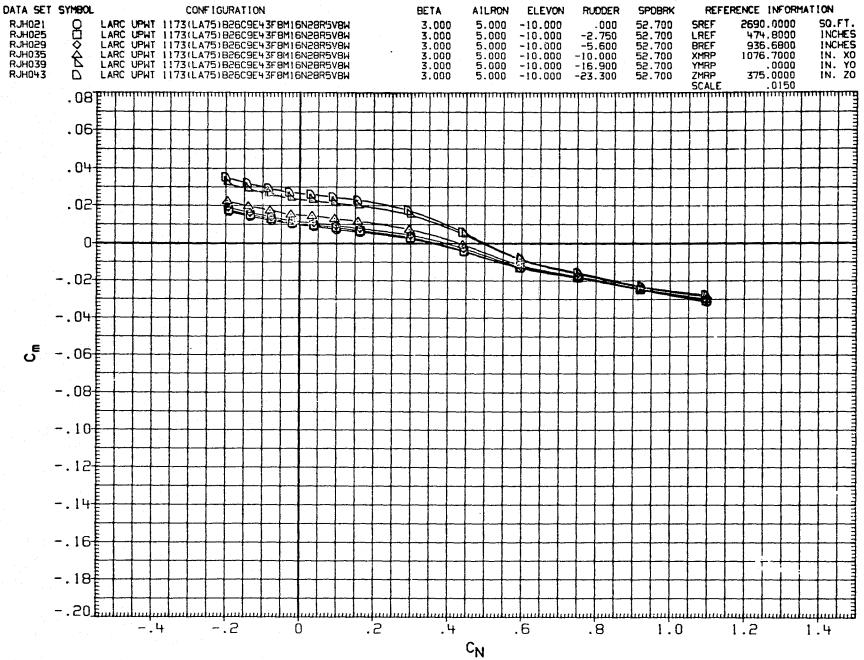


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(A) MACH = 2.86

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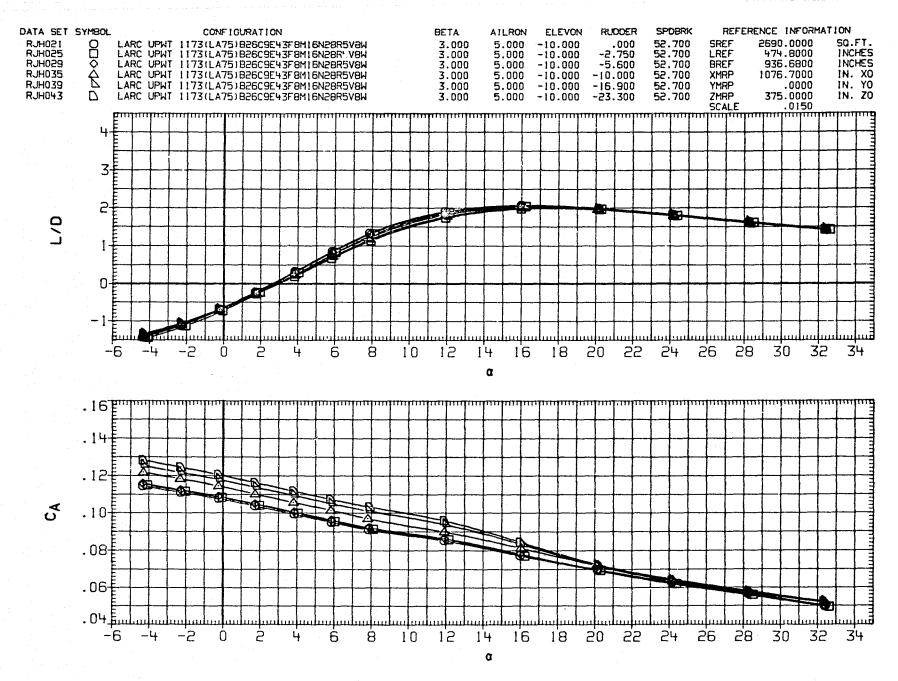


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

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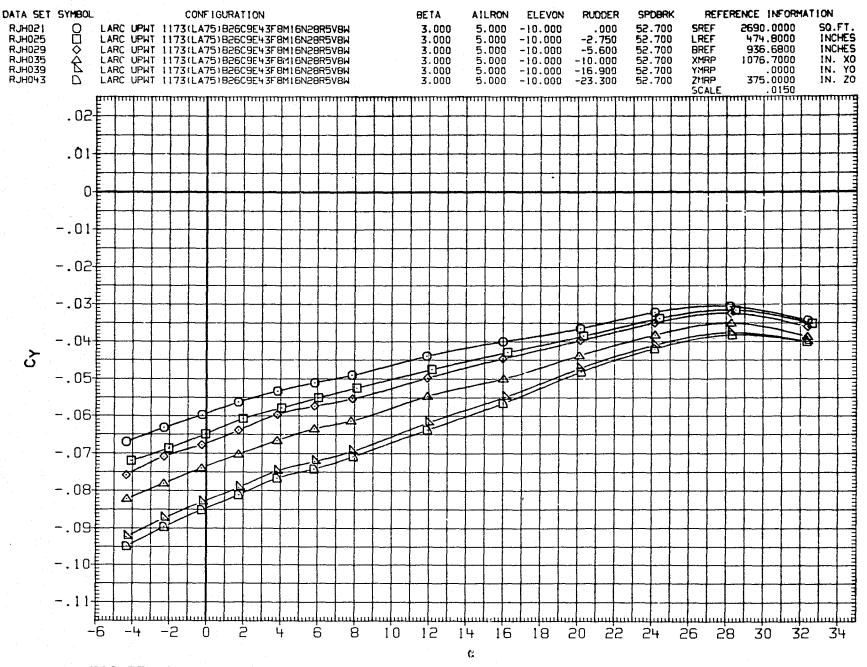


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

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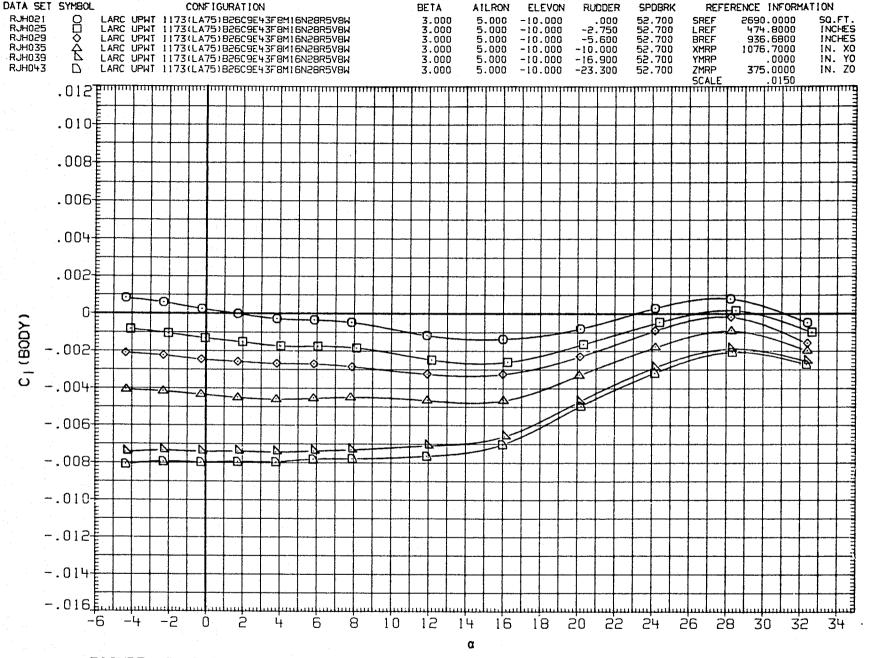


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

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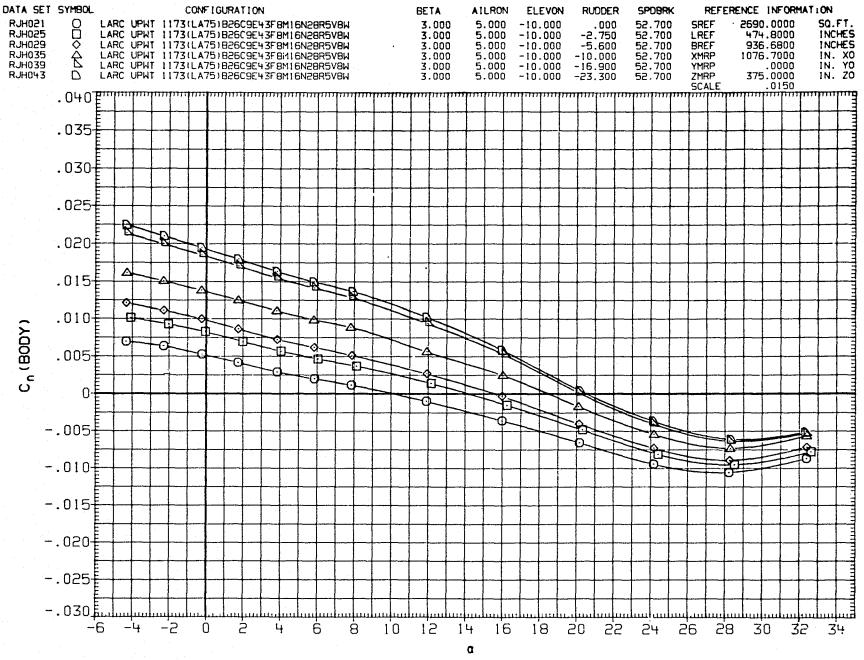


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

PAGE

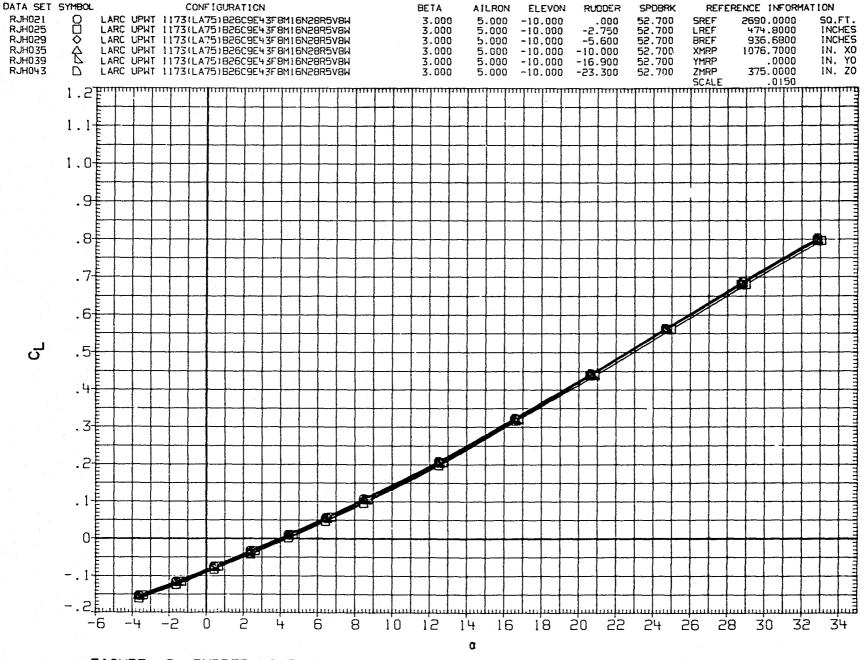


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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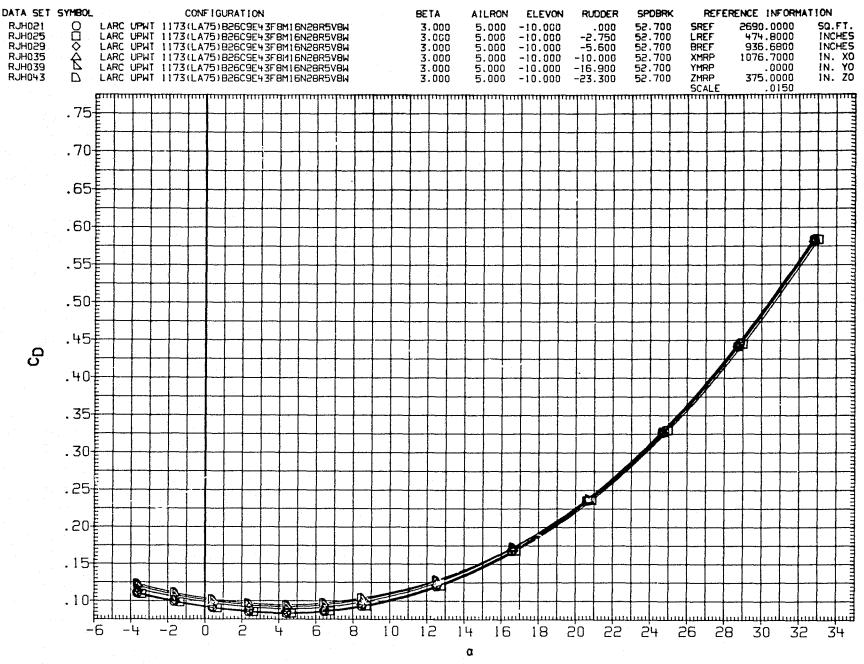


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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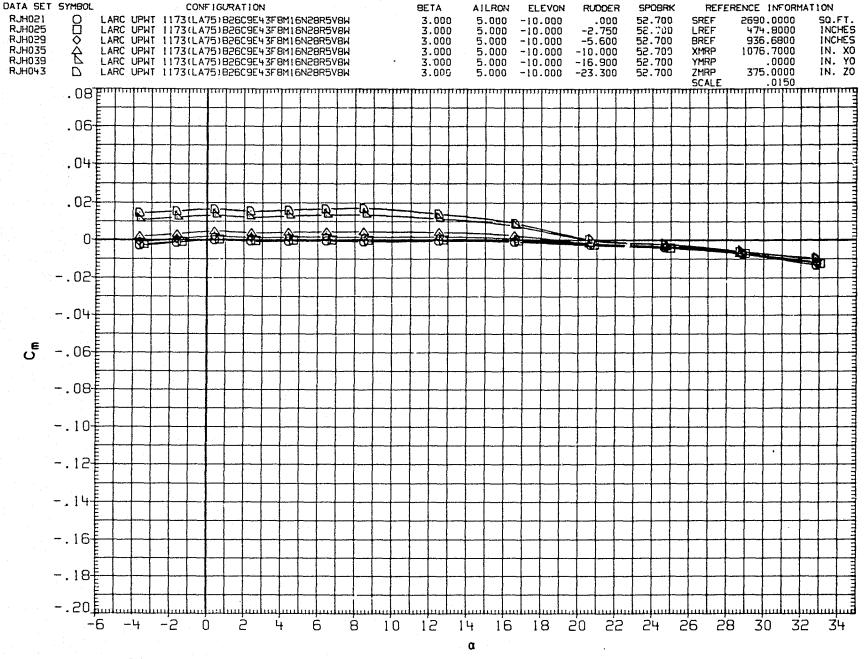


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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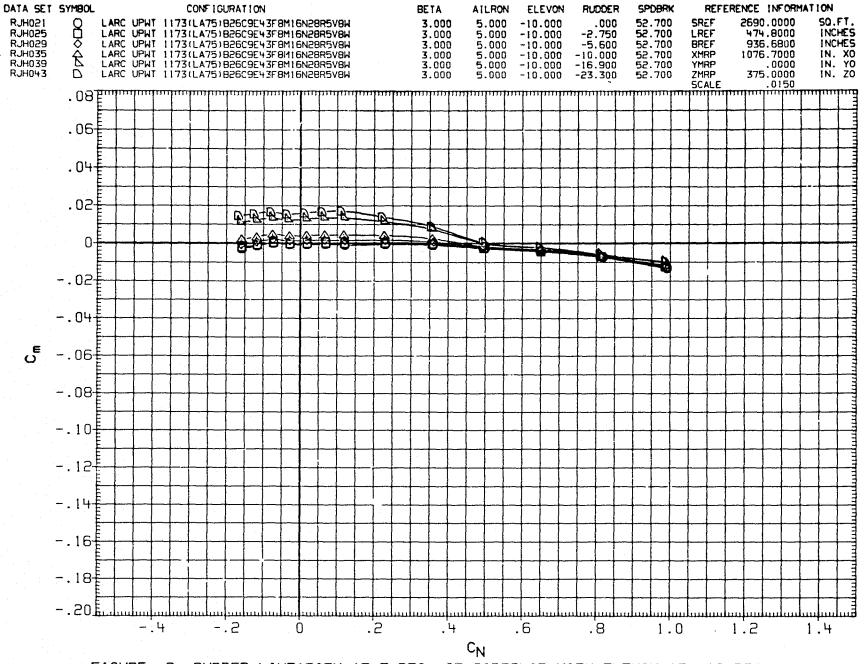


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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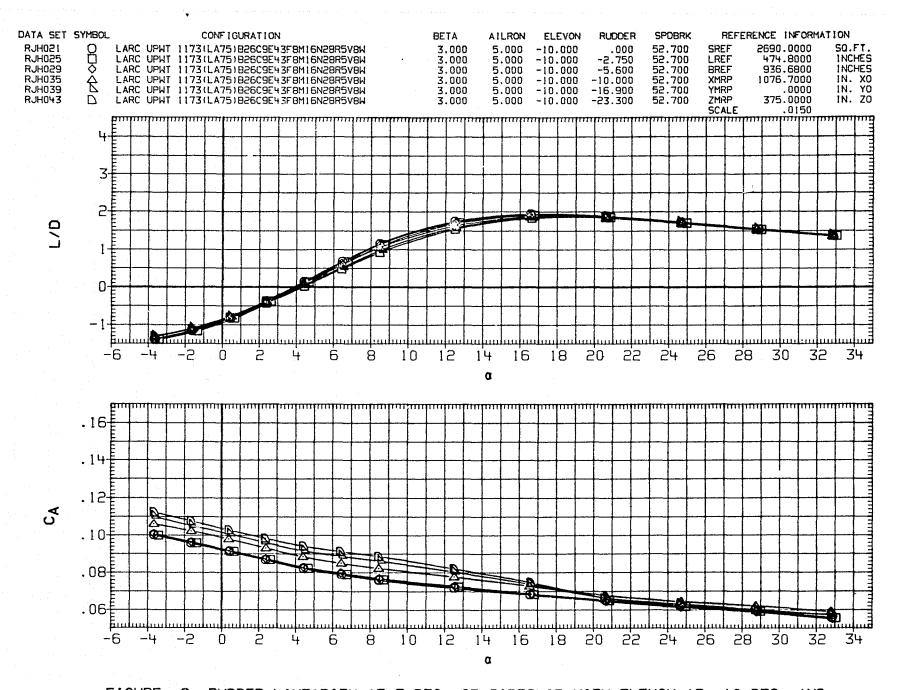


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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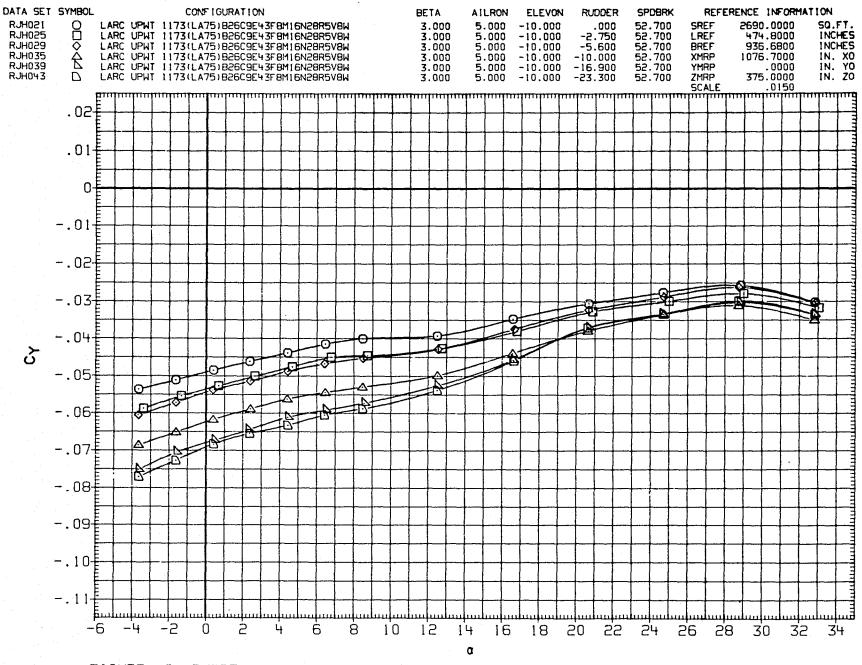


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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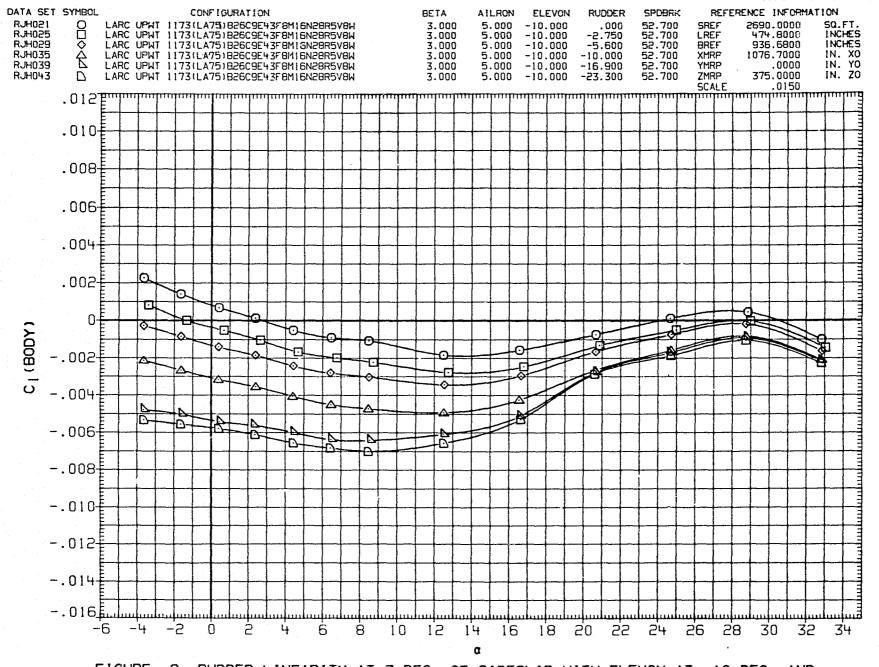


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90 PAGE 132

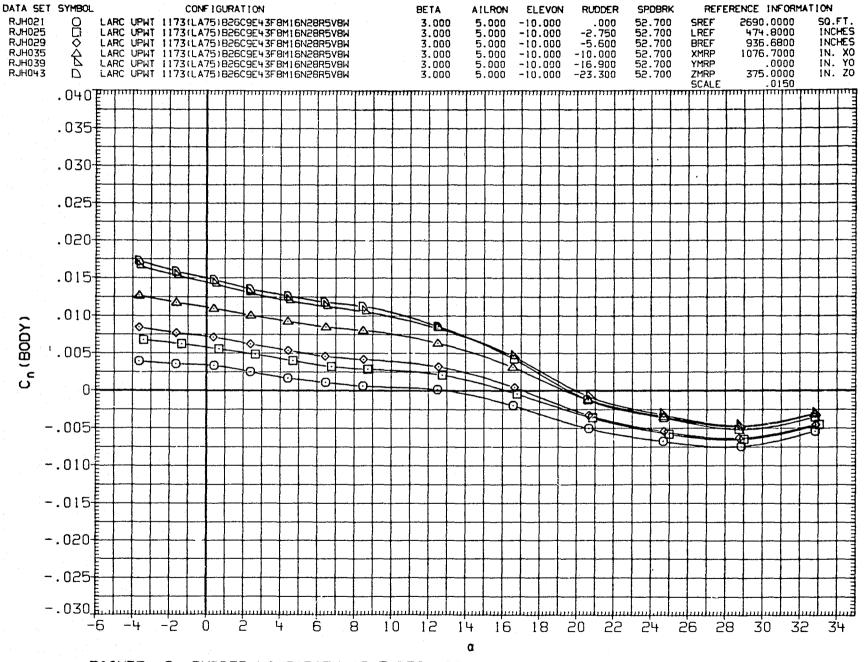


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND ALLERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

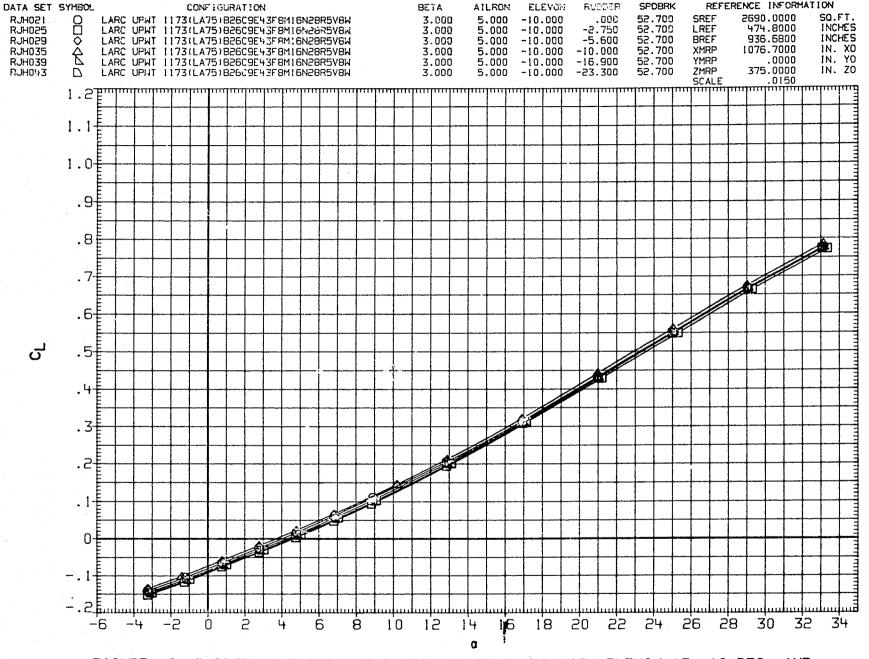


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDE LIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.80 PAGE 134

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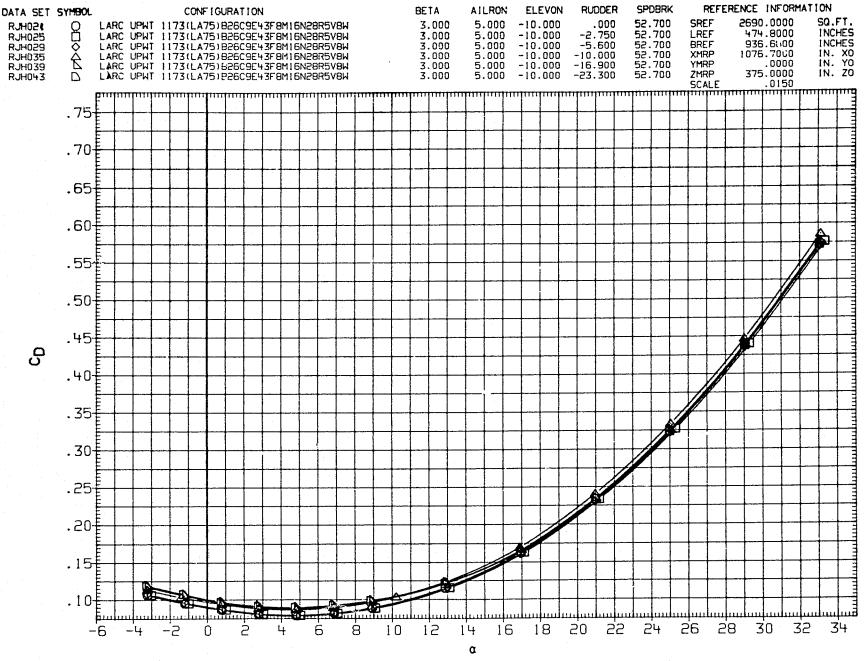


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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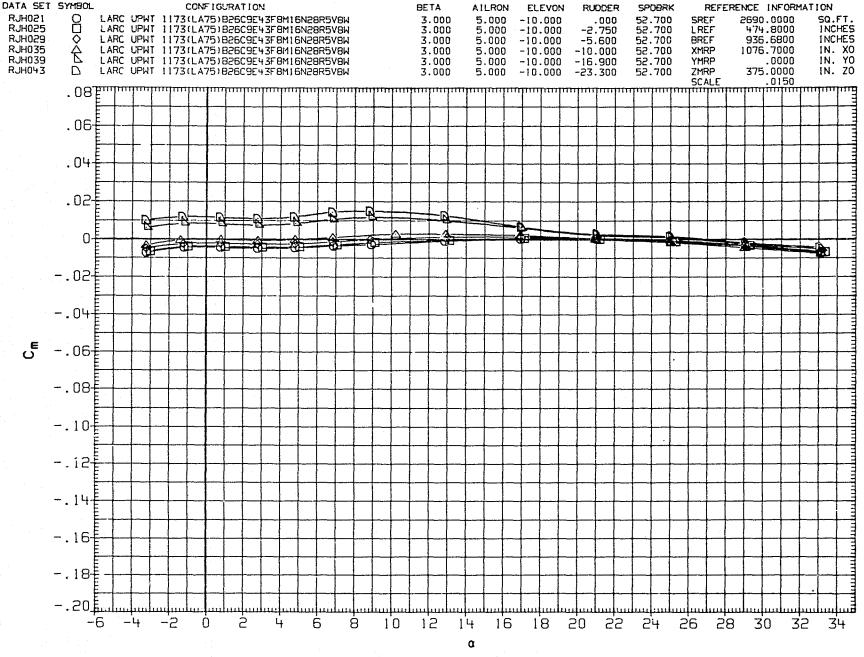


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60 PAGE 136

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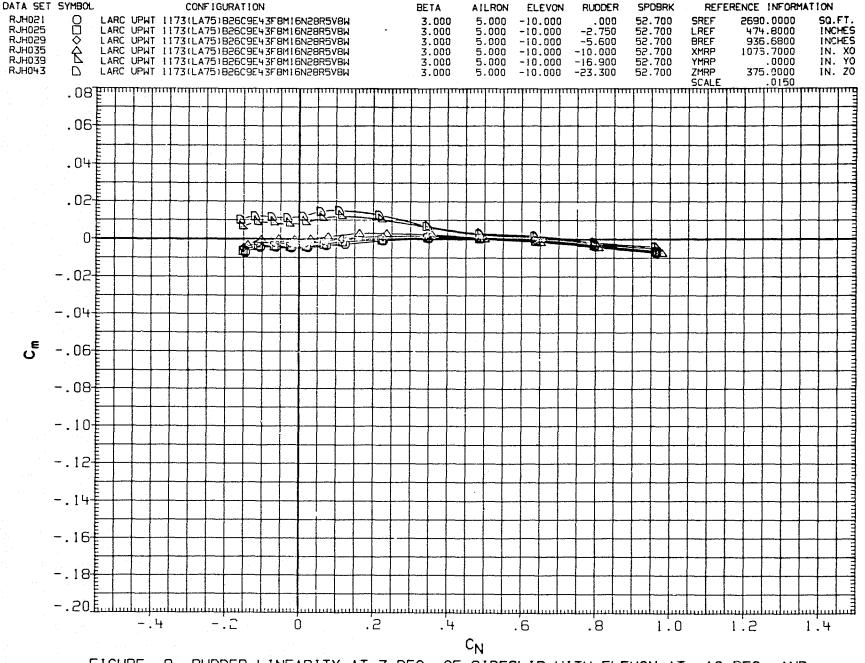


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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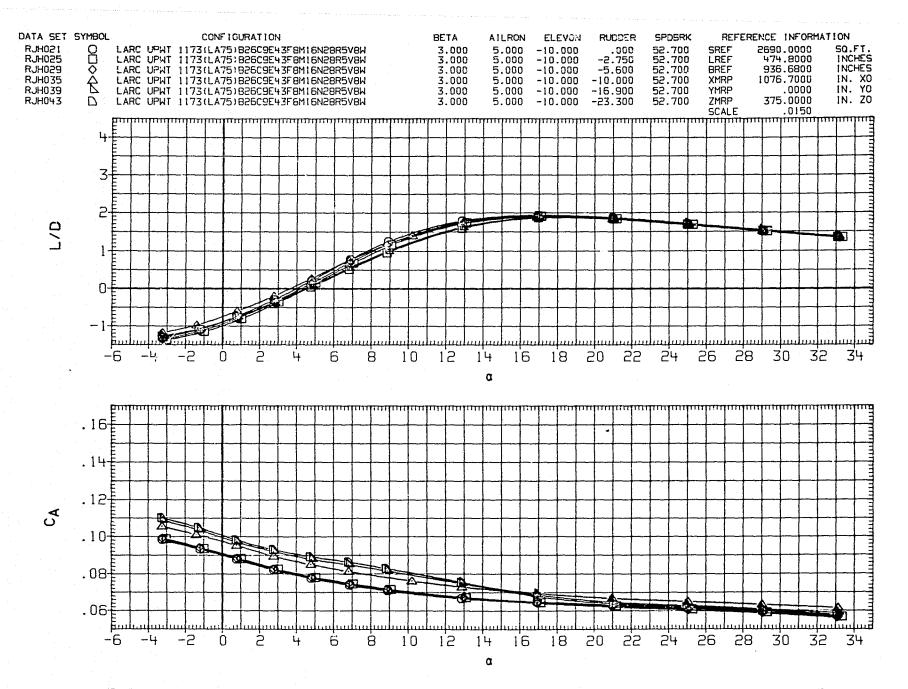


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60 PAGE 138

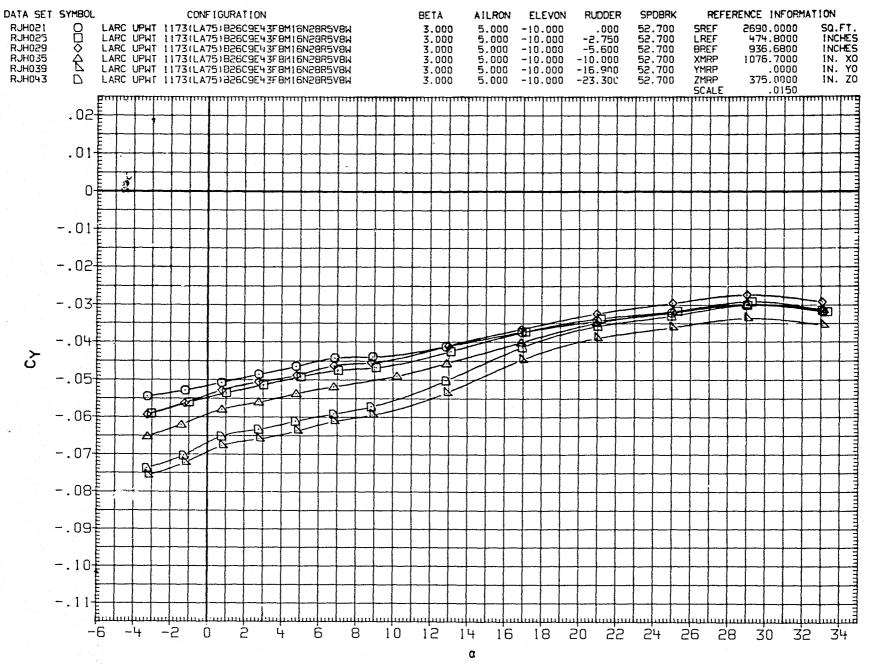


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDER IP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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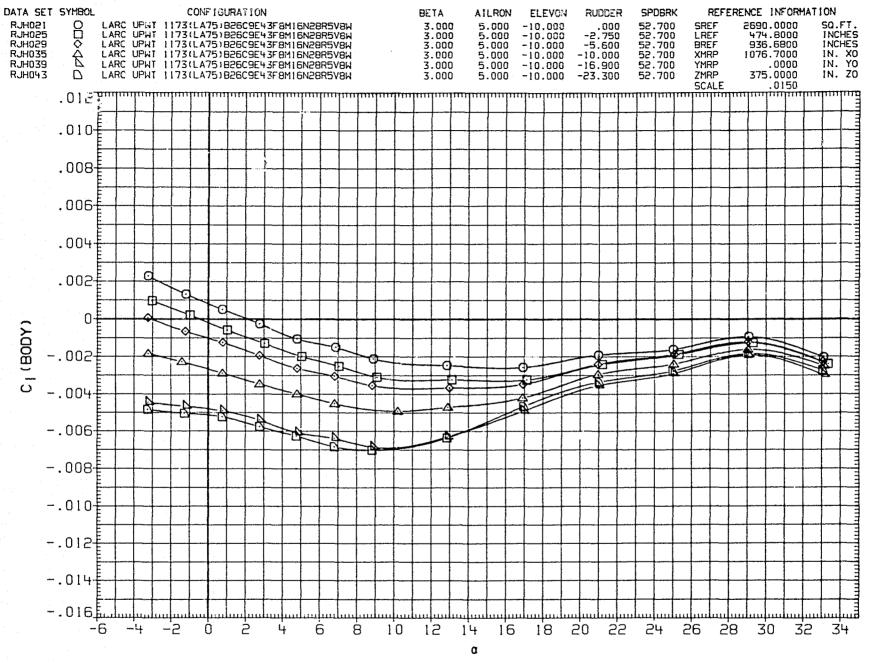


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60 PAGE 140

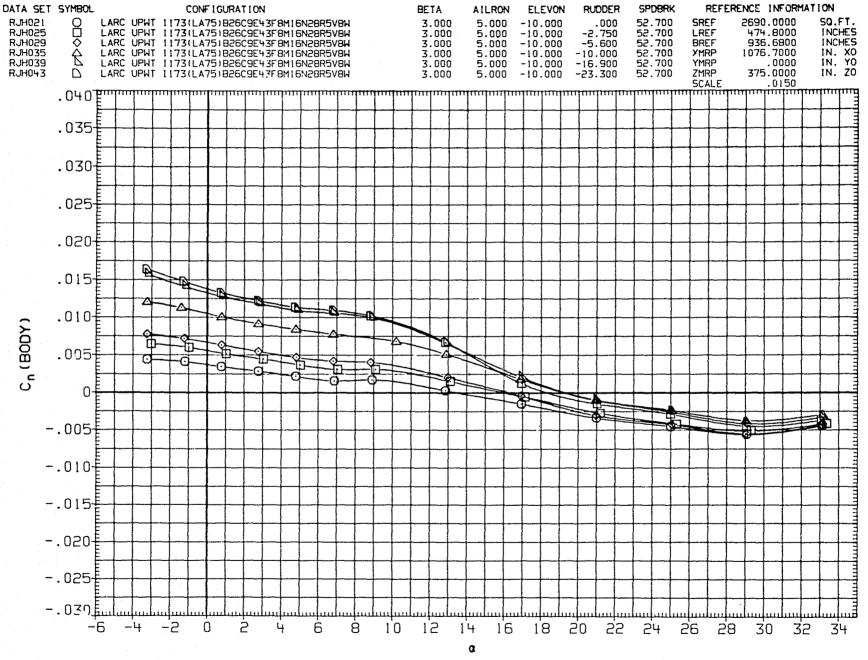


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60

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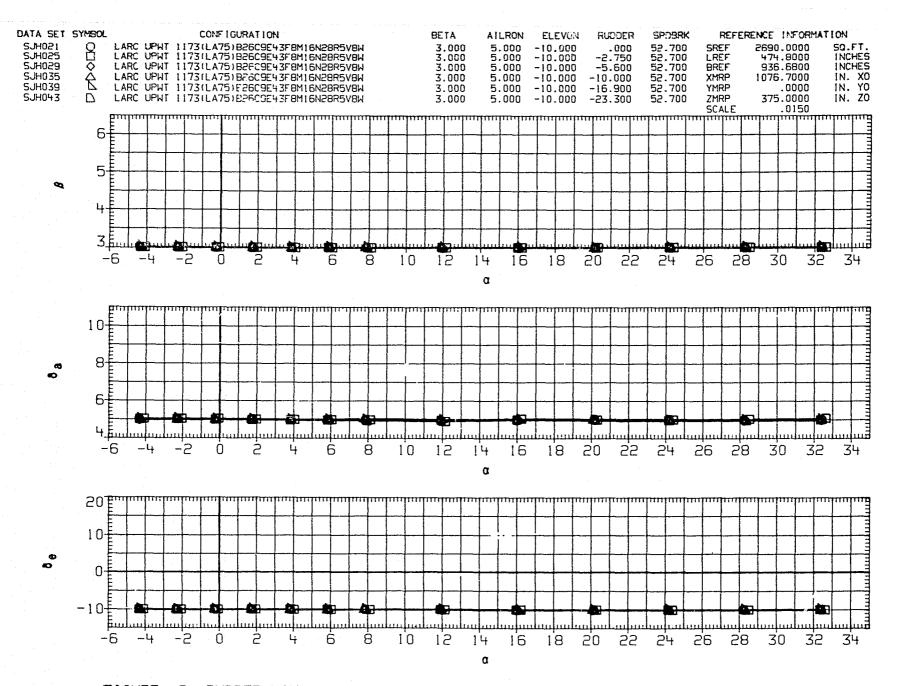


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86

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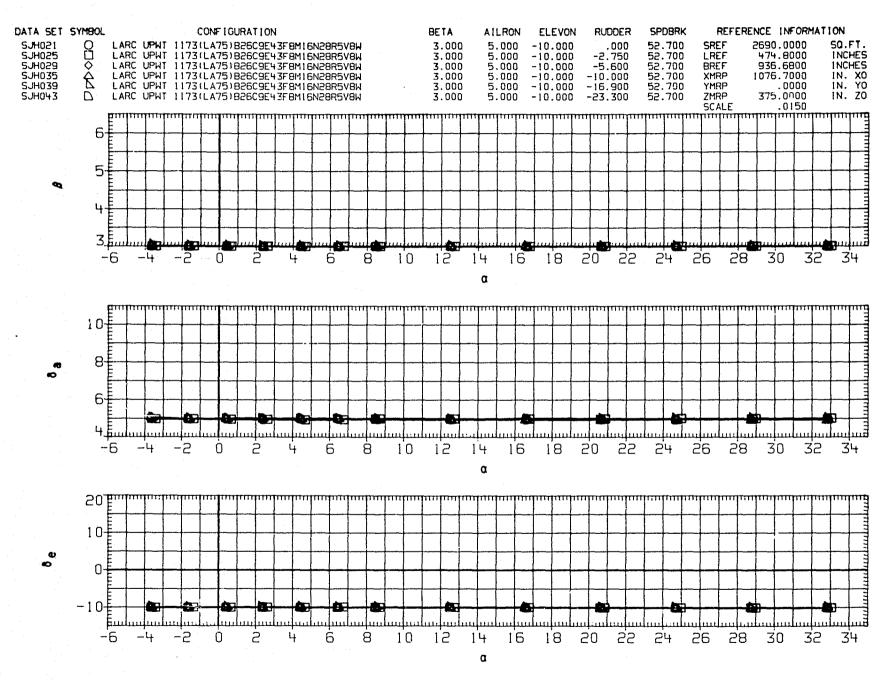


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(B) MACH = 3.90

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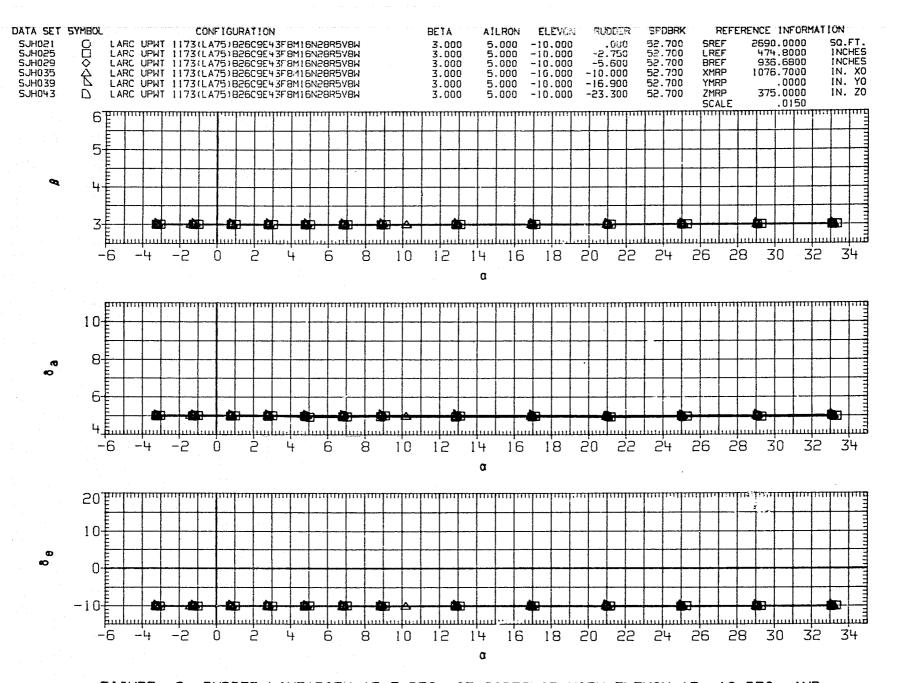


FIGURE 8. RUDDER LINEARITY AT 3 DEG. OF SIDESLIP WITH ELEVON AT -10 DEG. AND AILERON AT 5 DEG., SPEED BRAKE AT 52.7 DEG.

(C) MACH = 4.60 PAGE 144

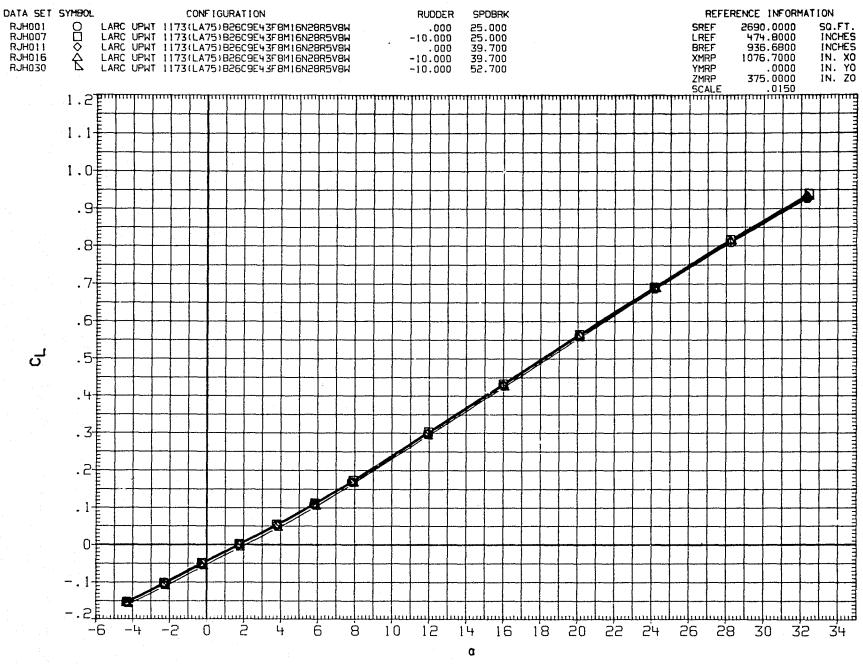


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

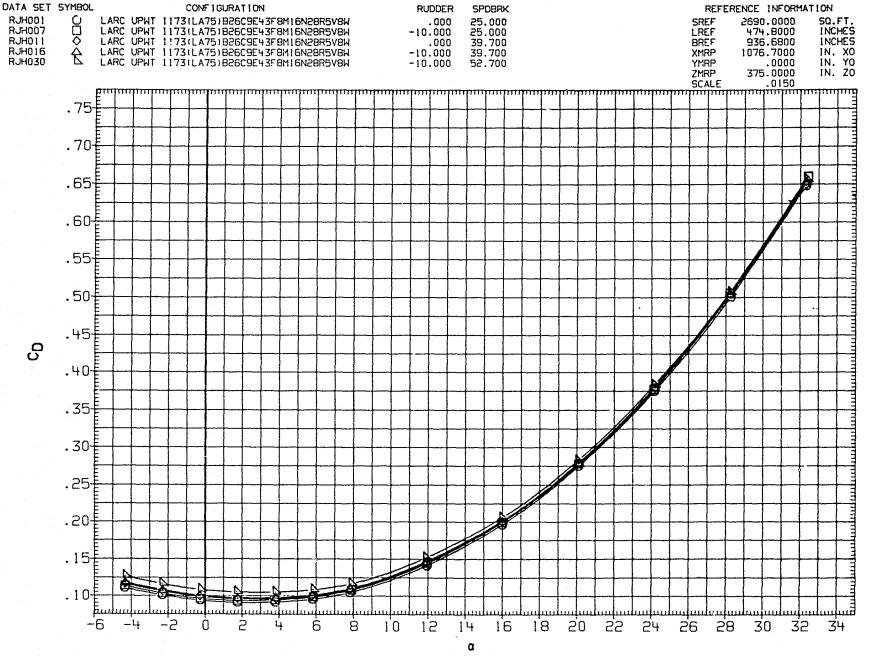


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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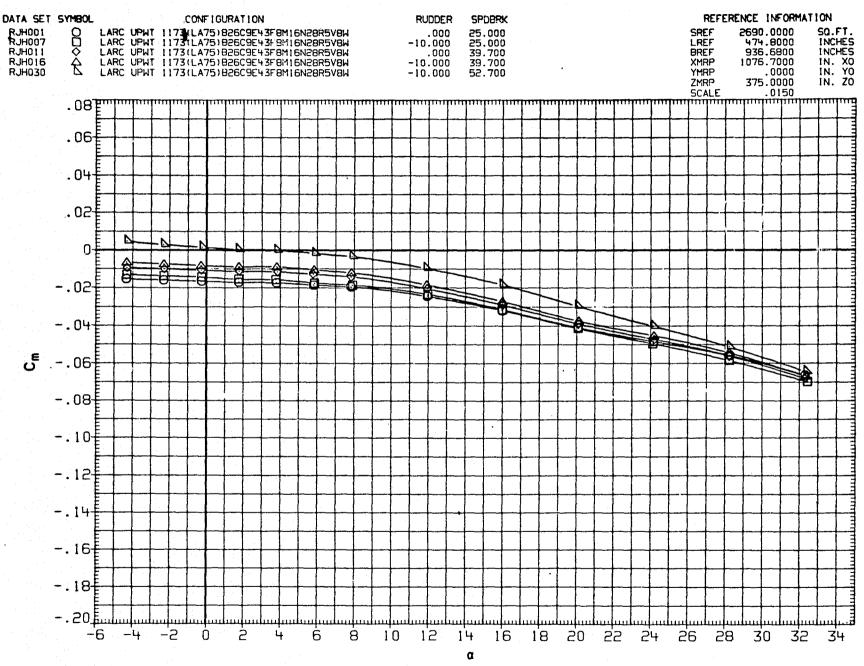


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

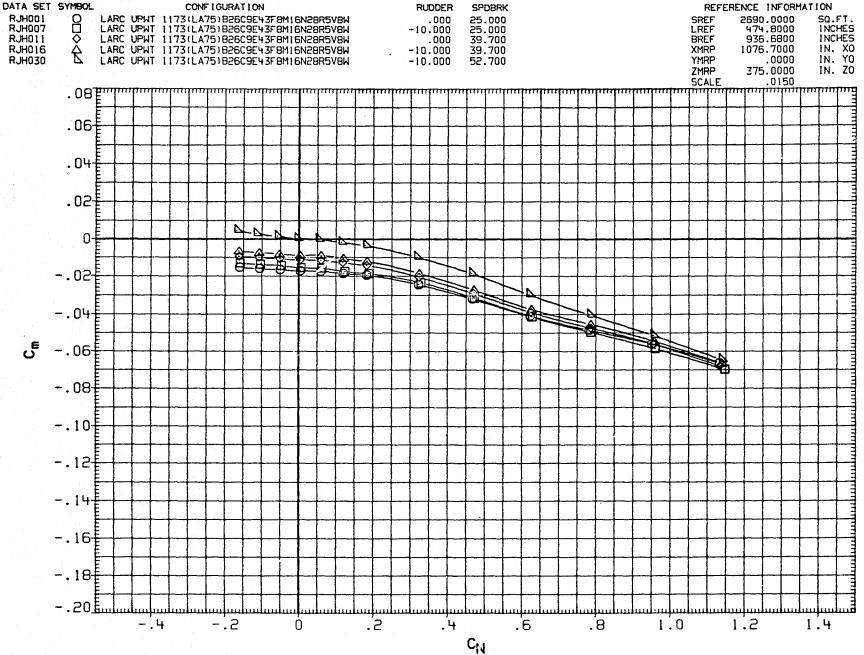


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

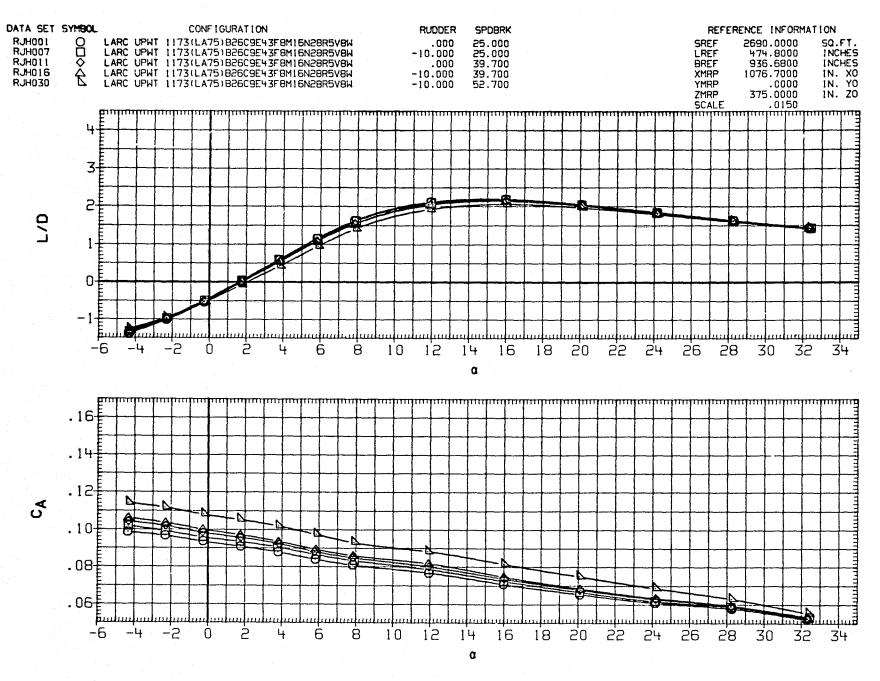


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

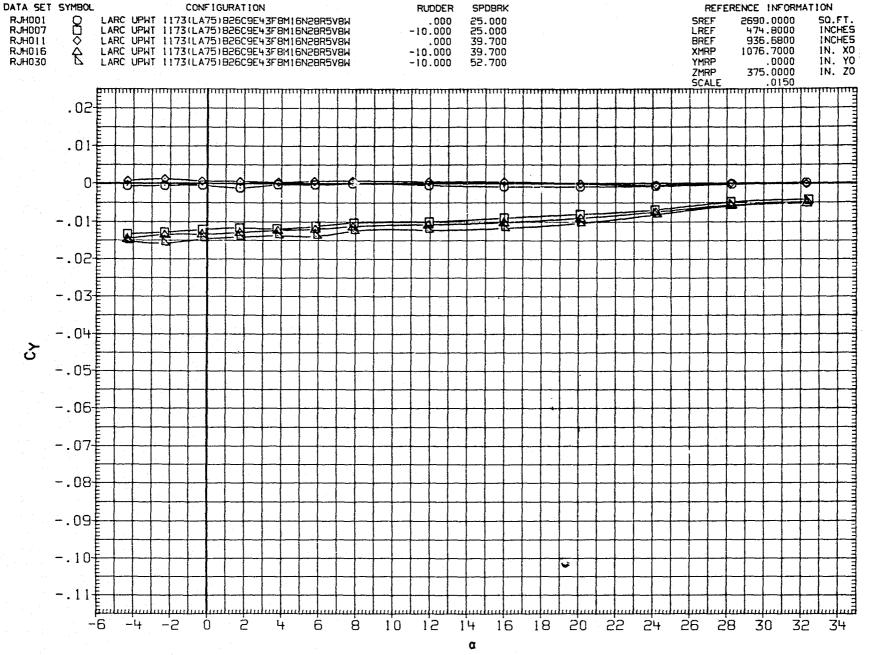


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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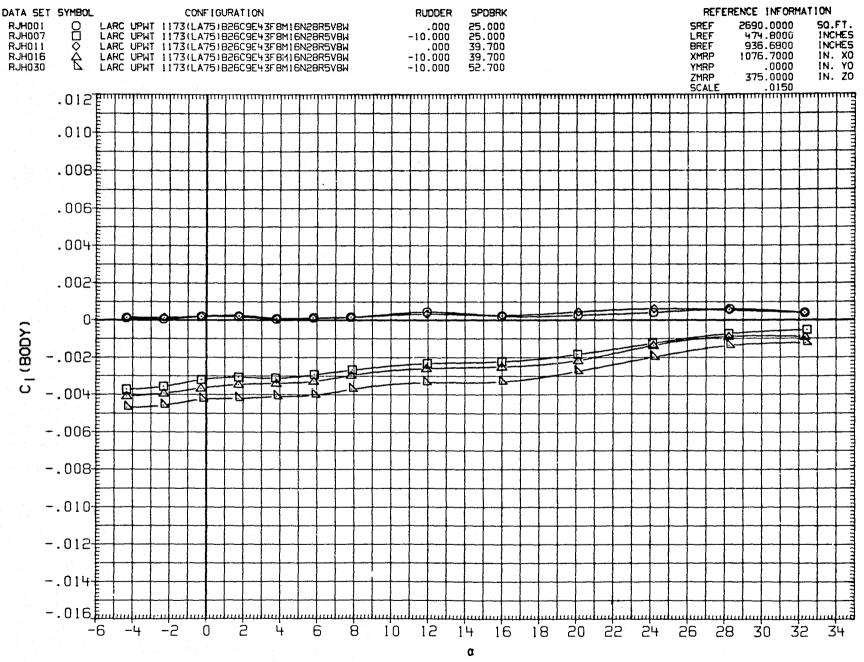


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

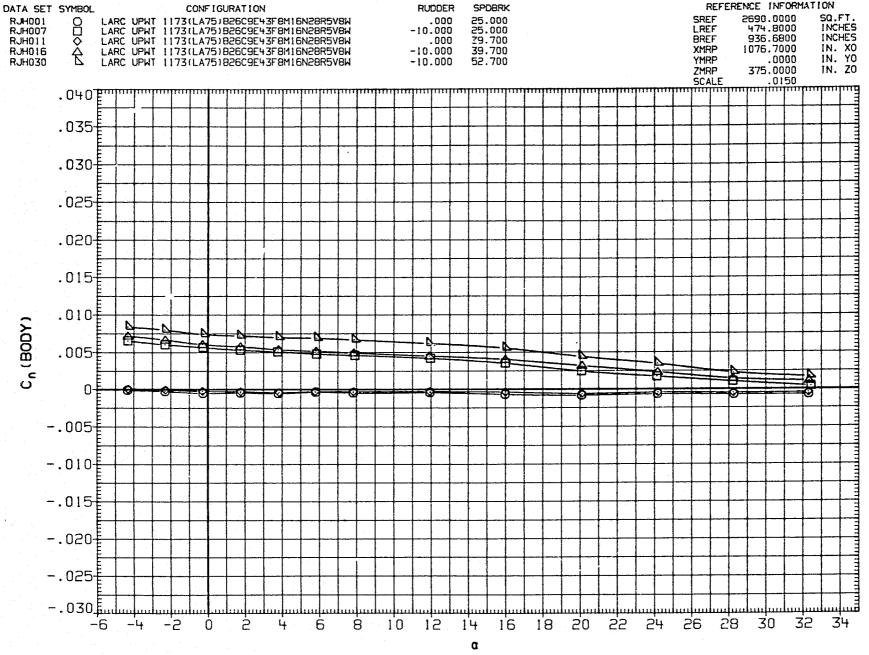


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

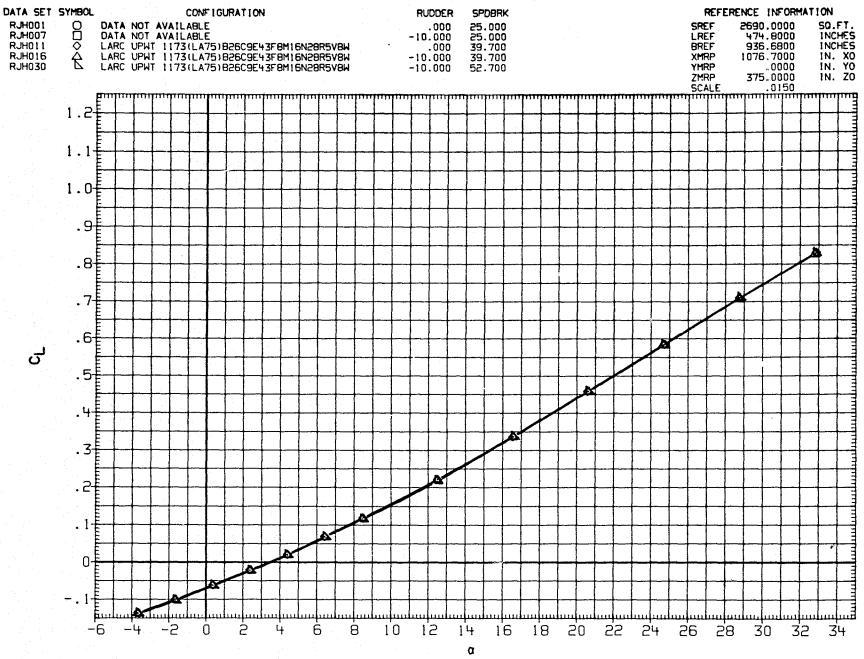


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

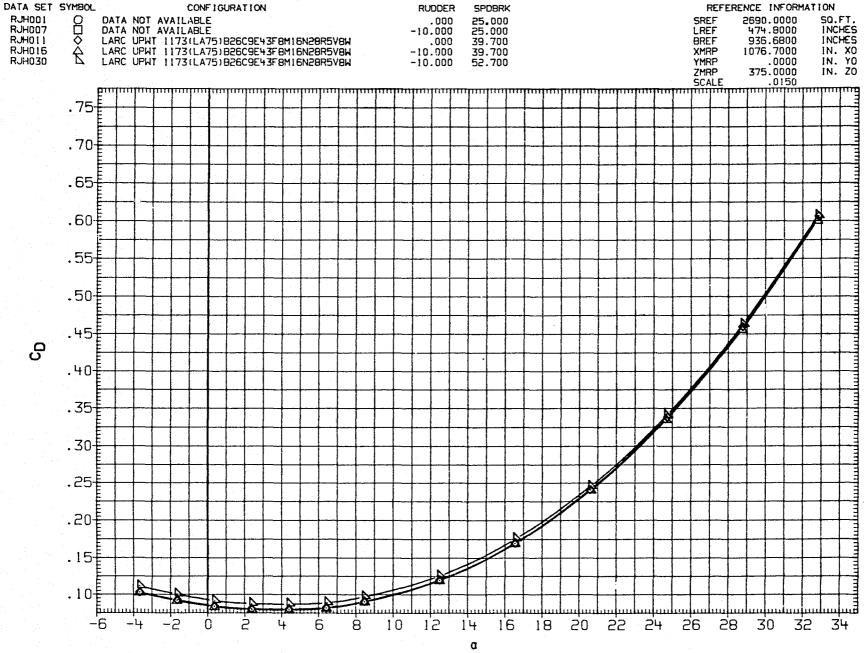


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

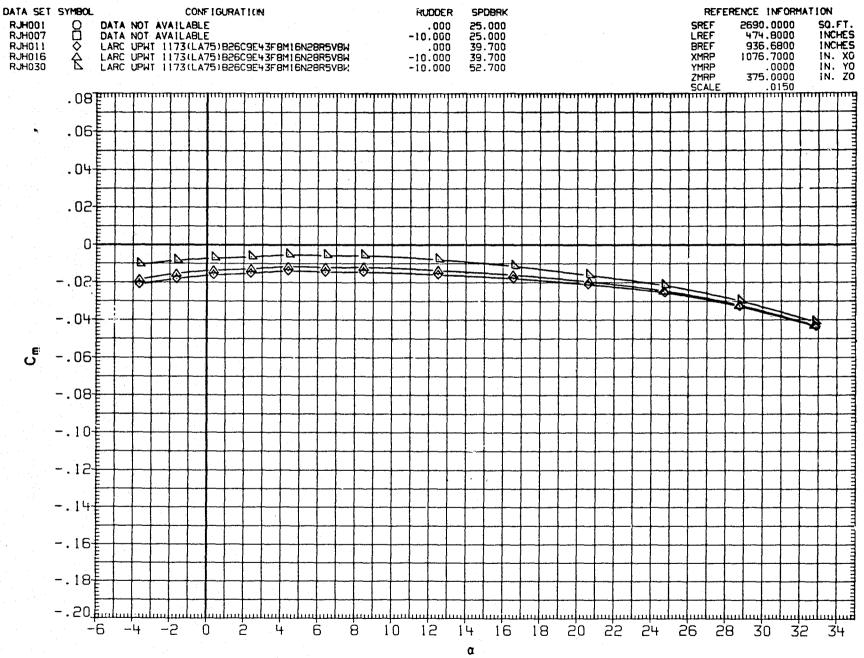


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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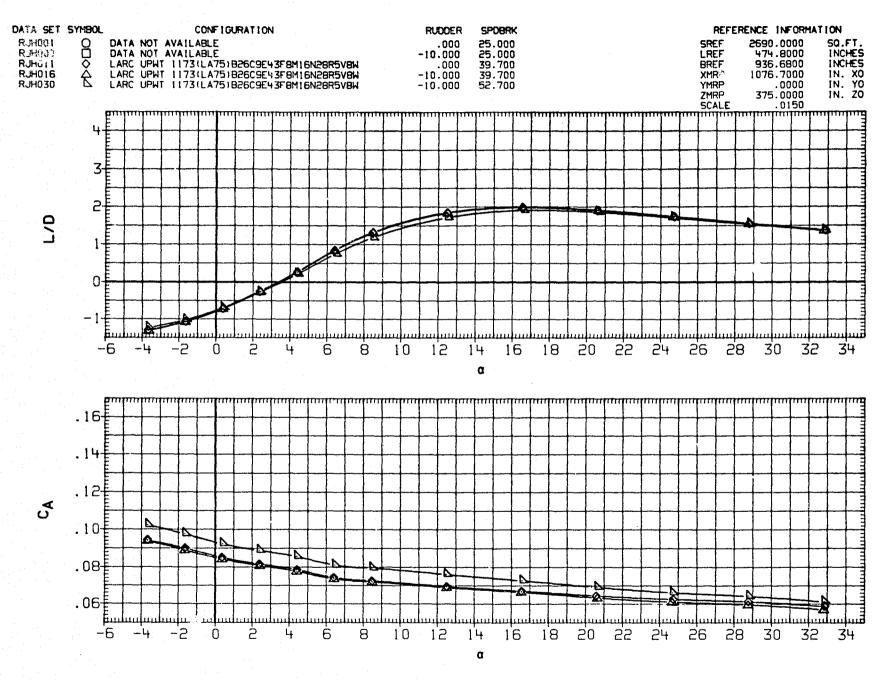


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

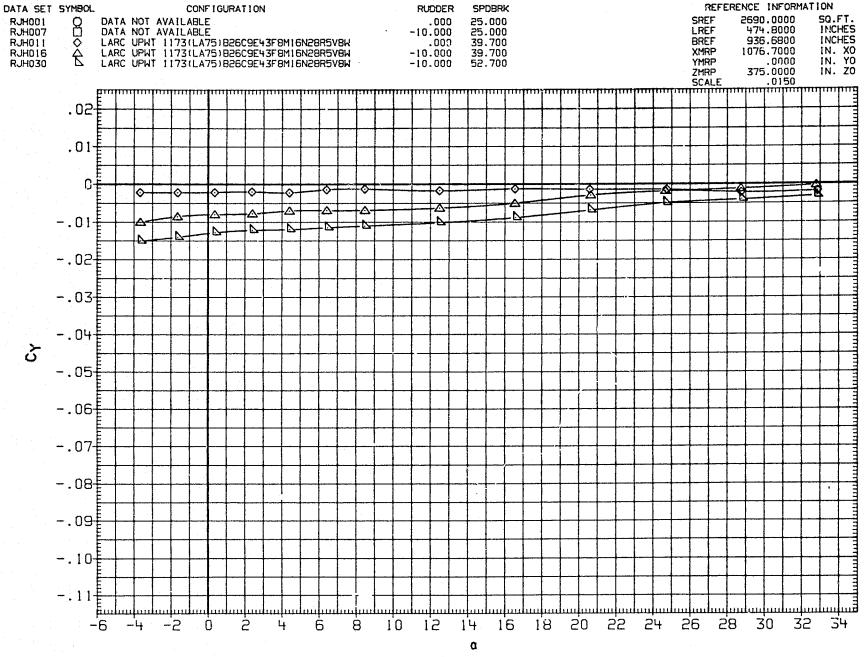


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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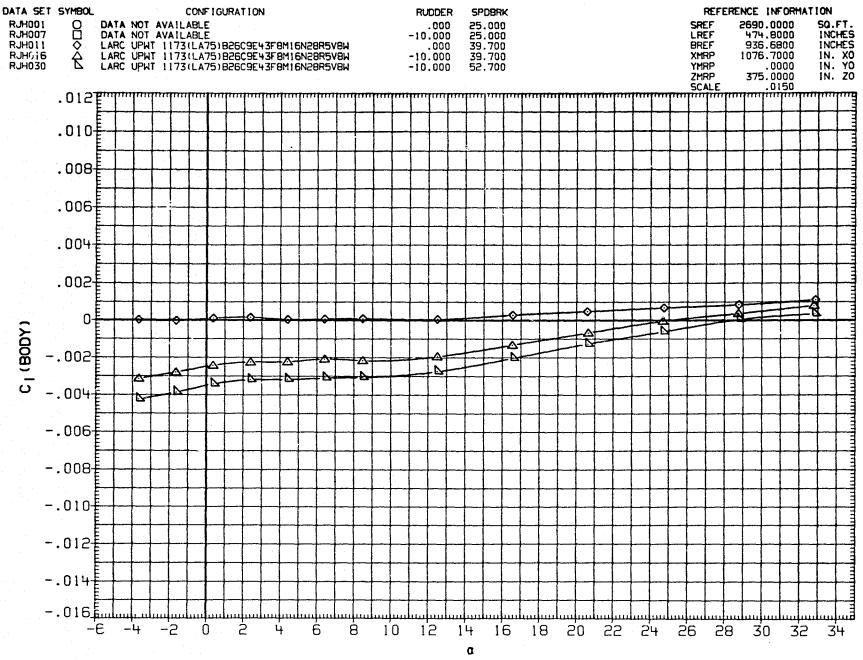


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

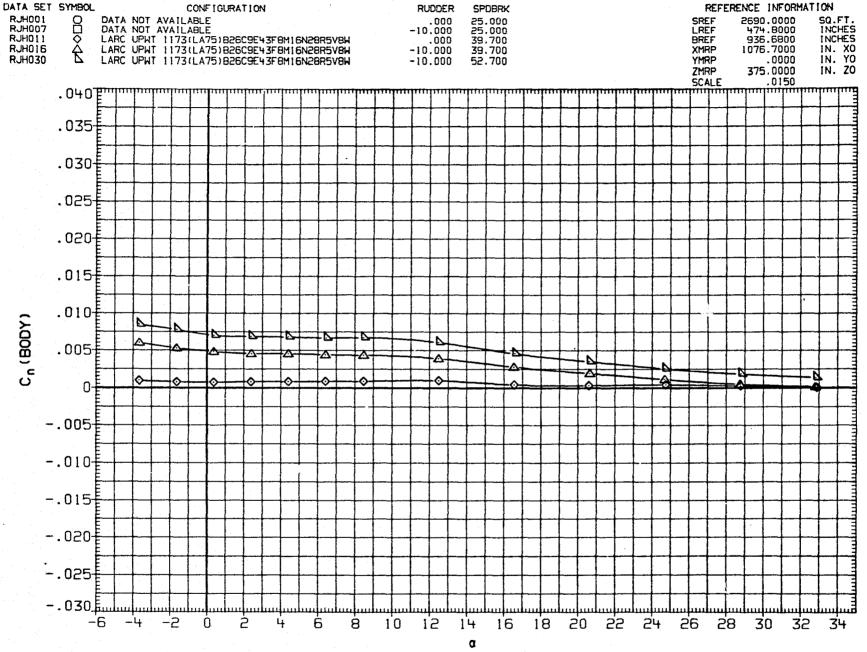


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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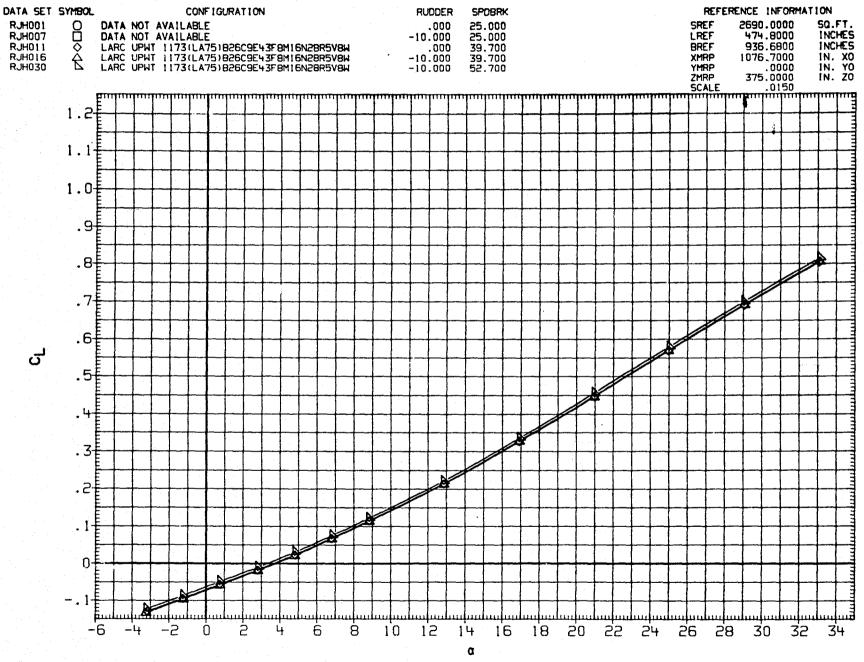


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

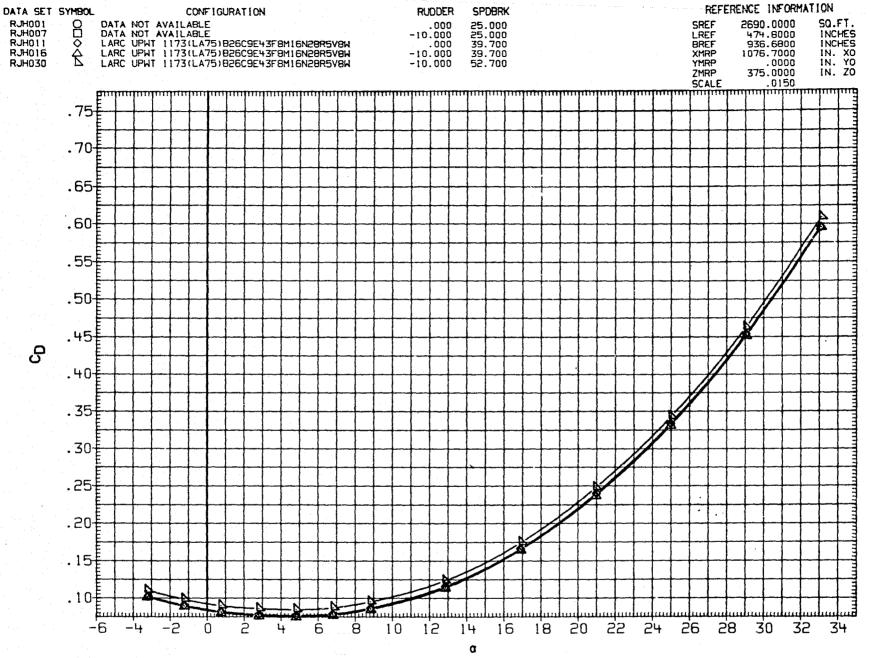


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

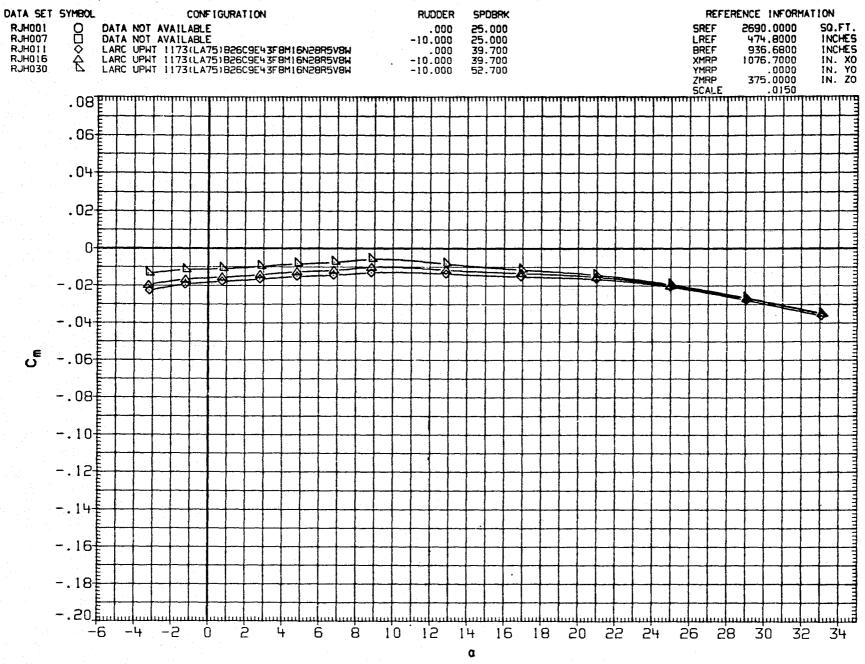


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

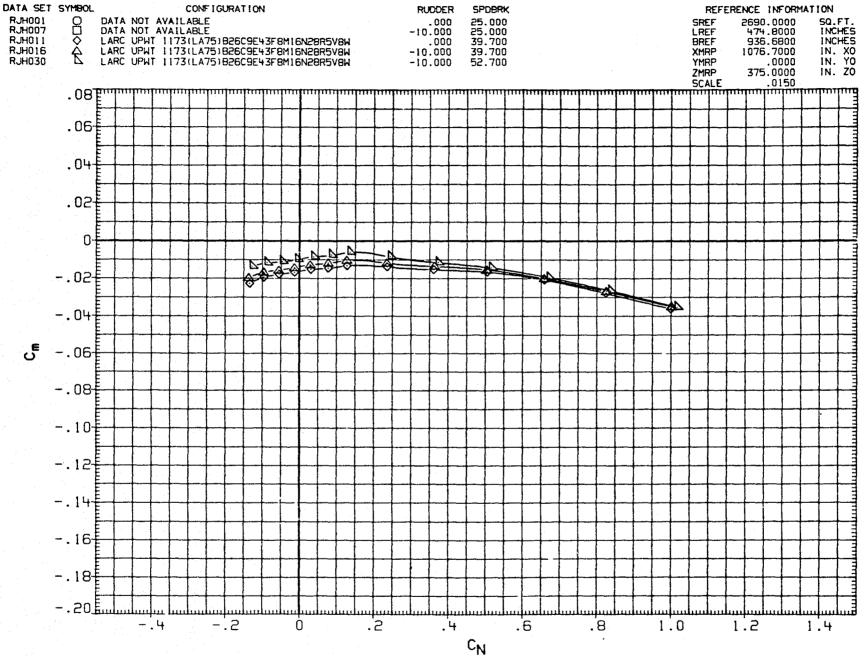


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

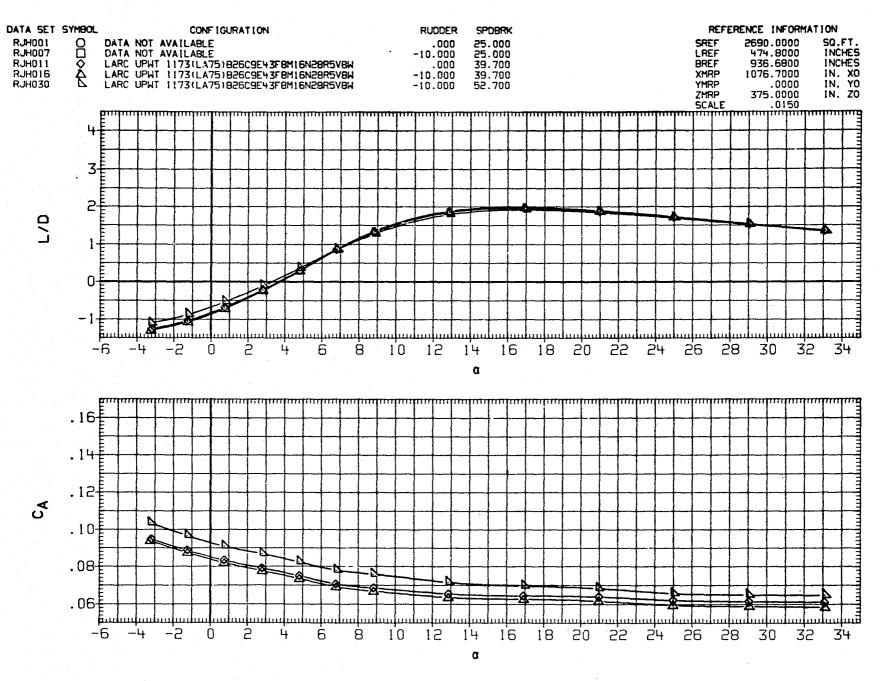


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

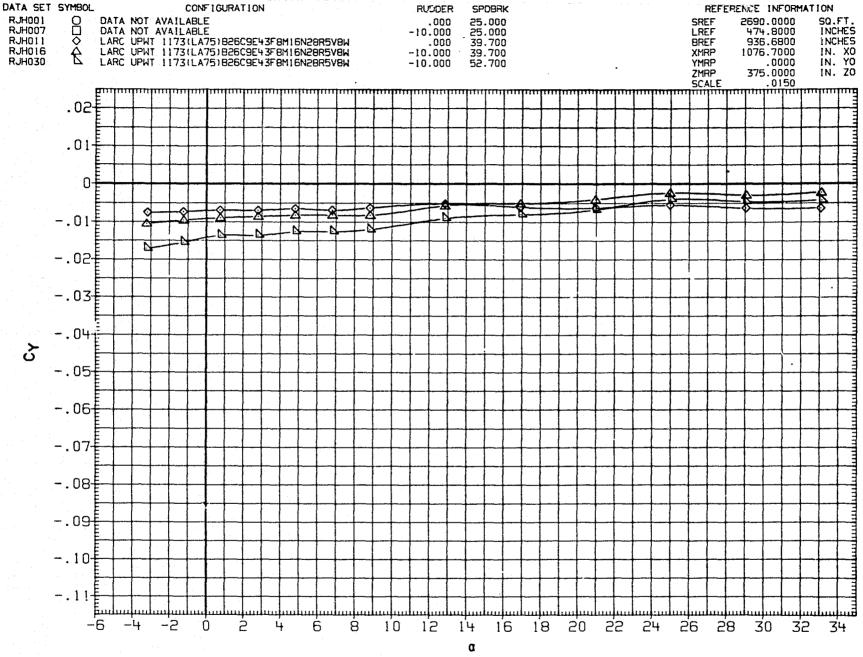


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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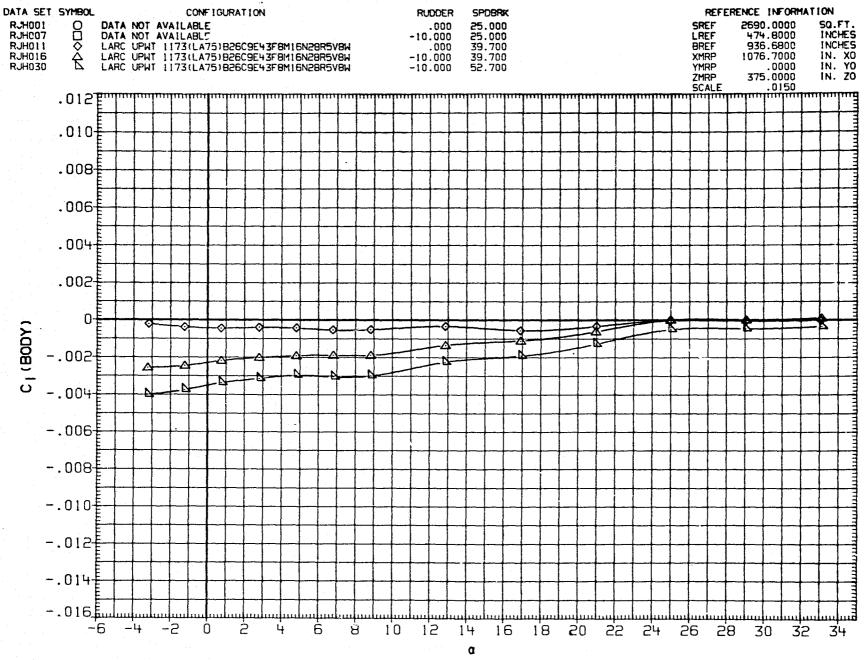


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

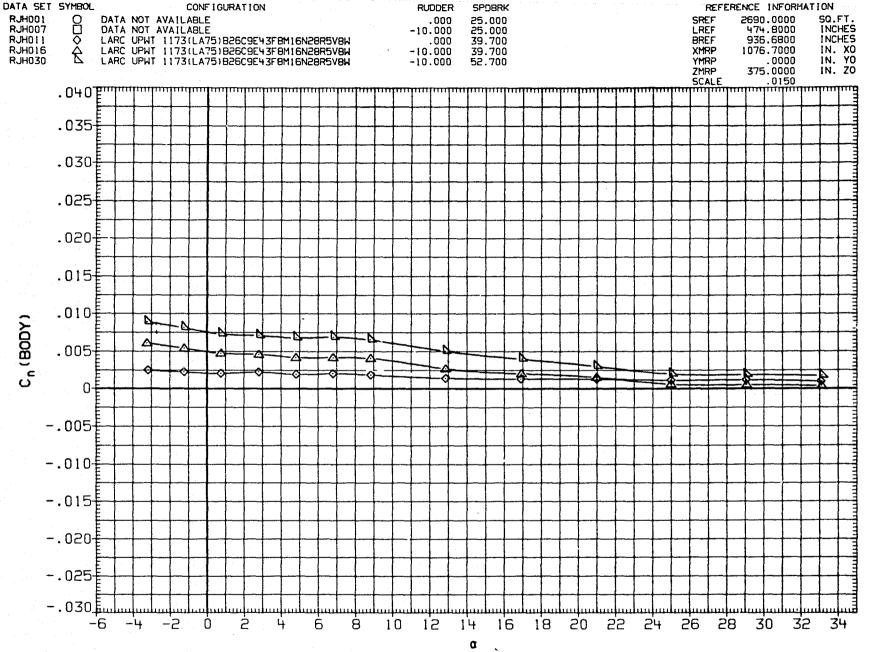


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

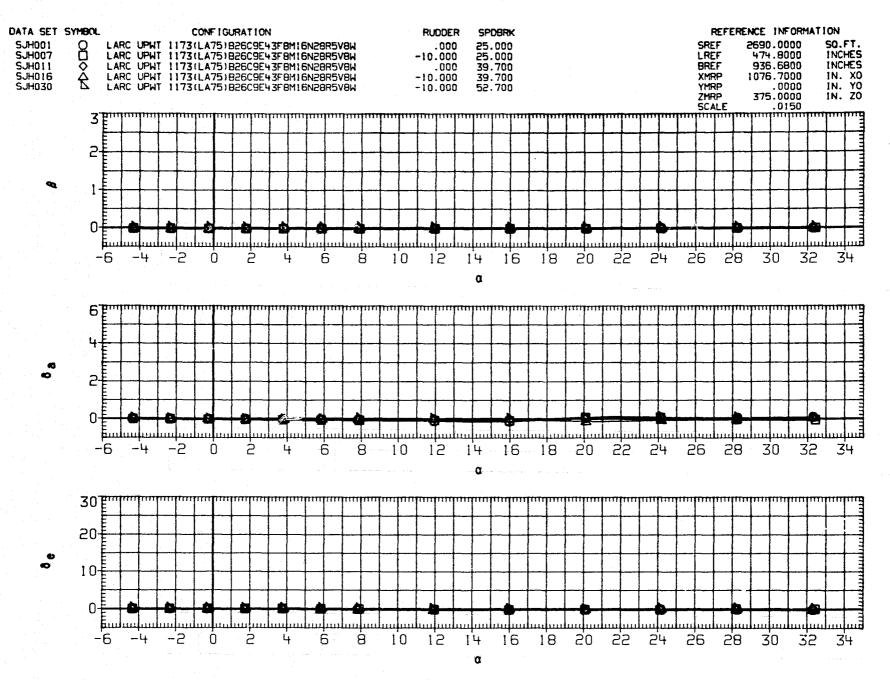


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

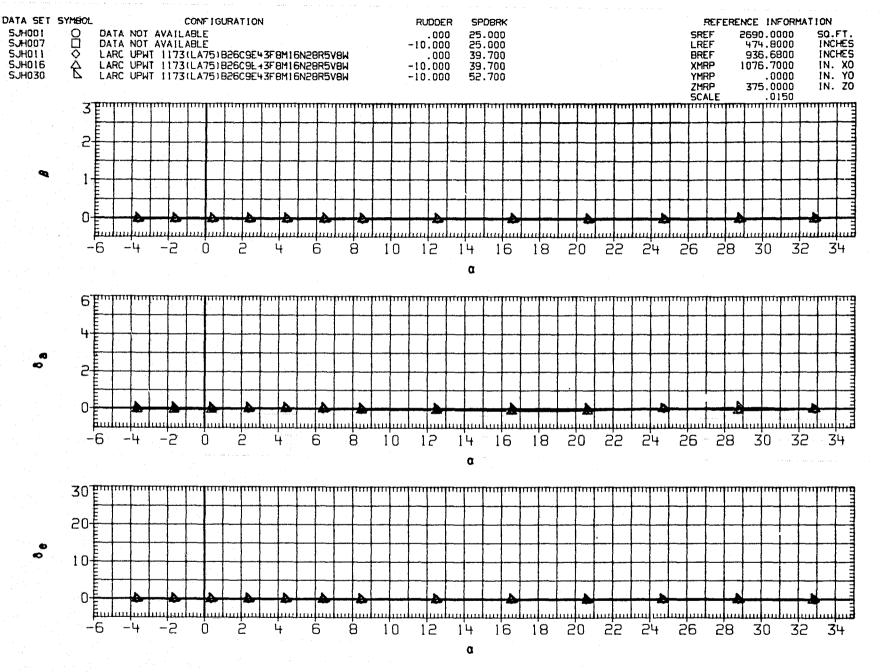


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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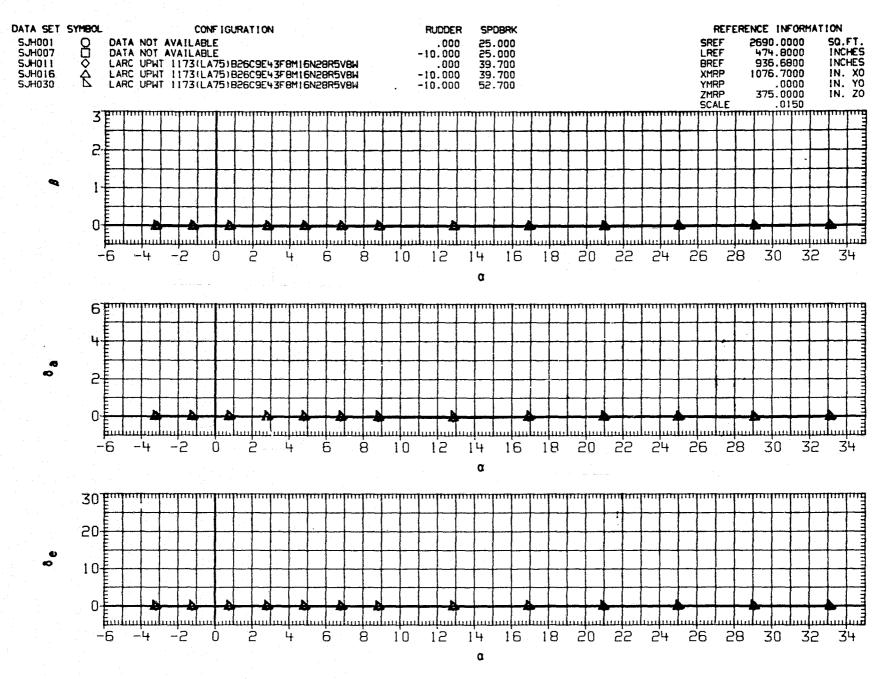


FIGURE 9(A). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

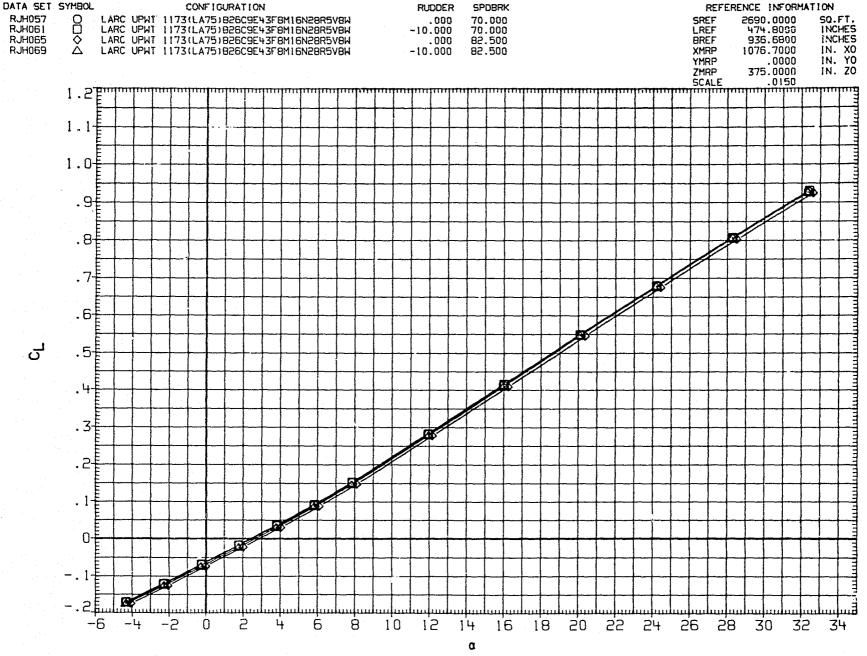


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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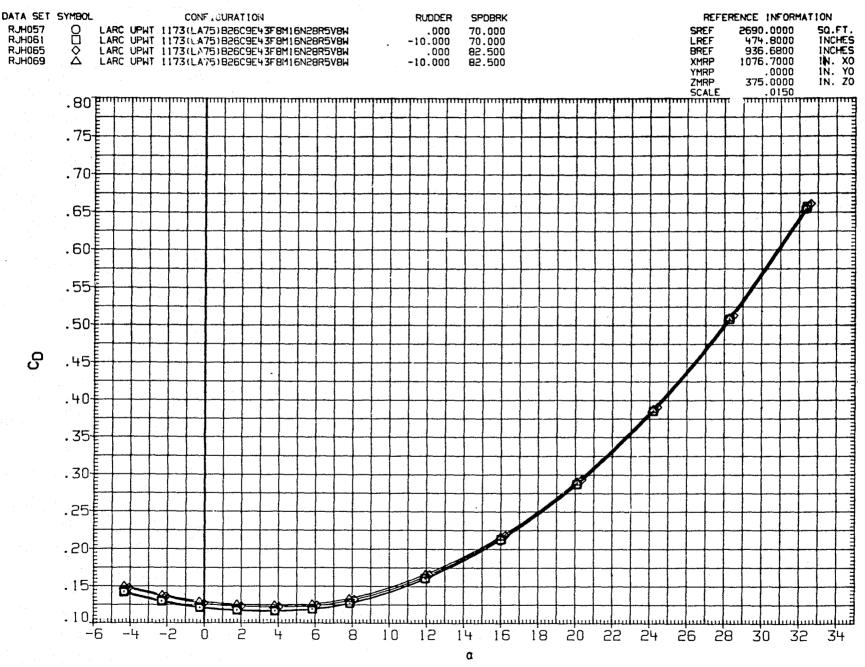
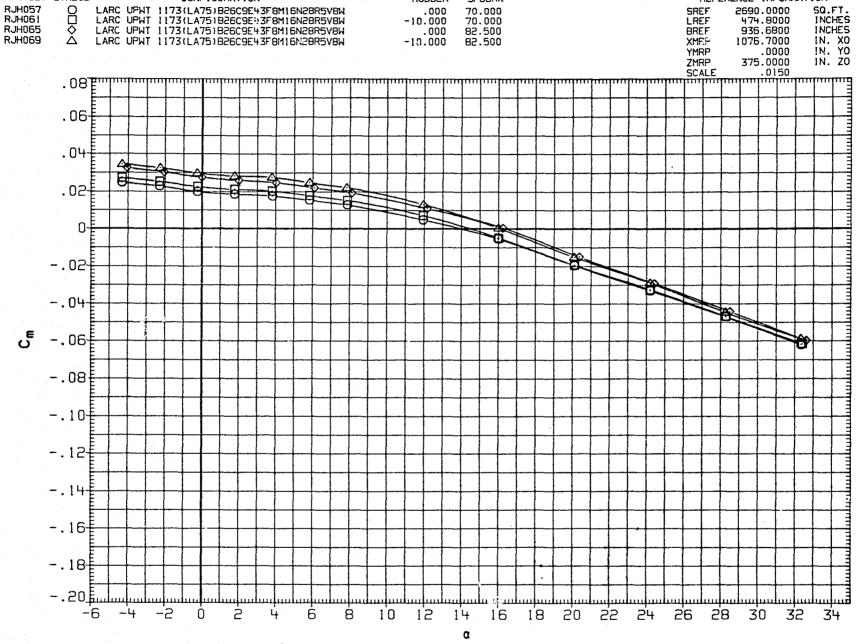


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS



RUDDER

SPDBRK

FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(A)MACH = 2.86

DATA SET SYMBOL

CONFIGURATION

PAGE

REFERENCE INFORMATION

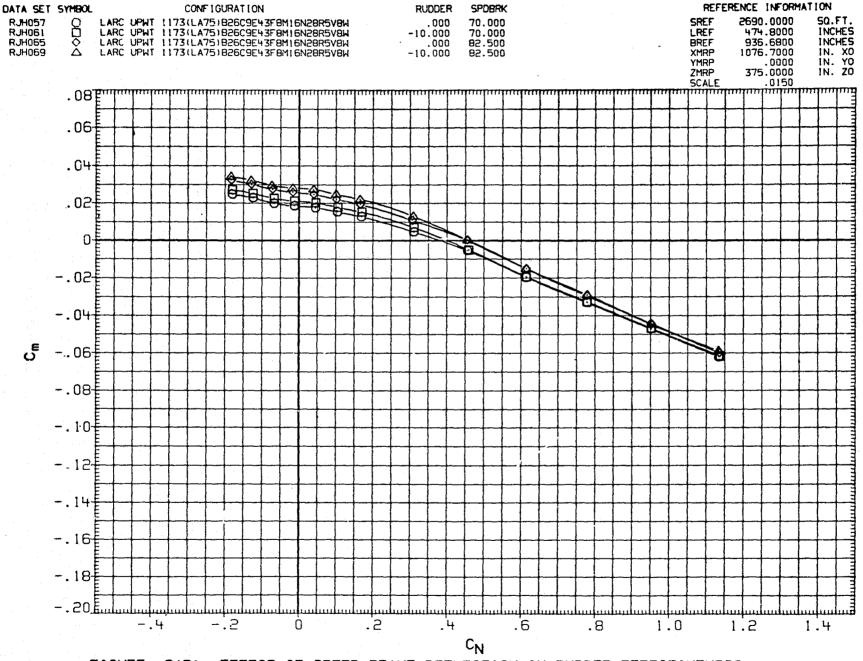


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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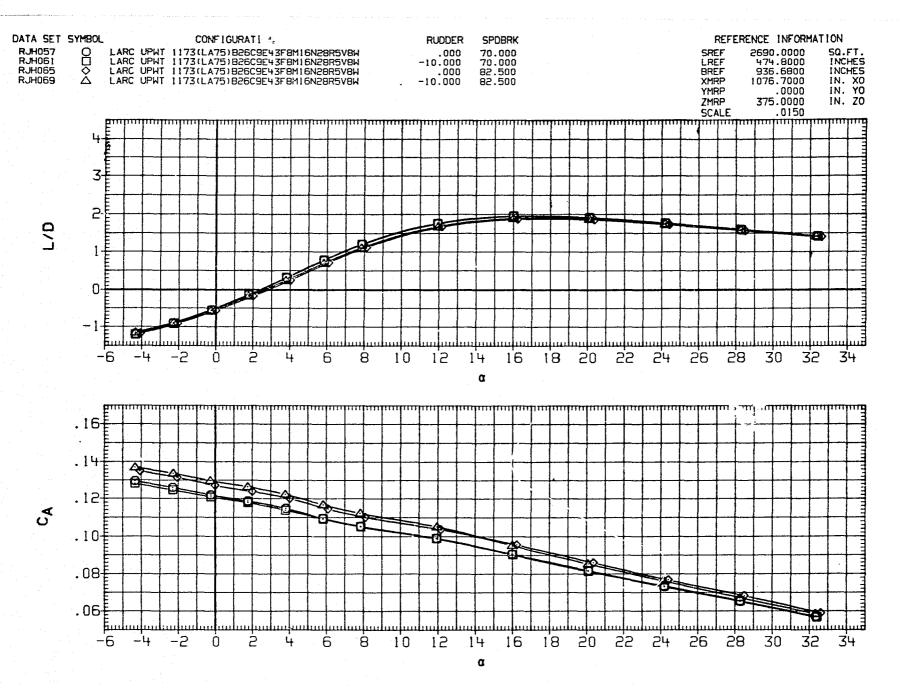


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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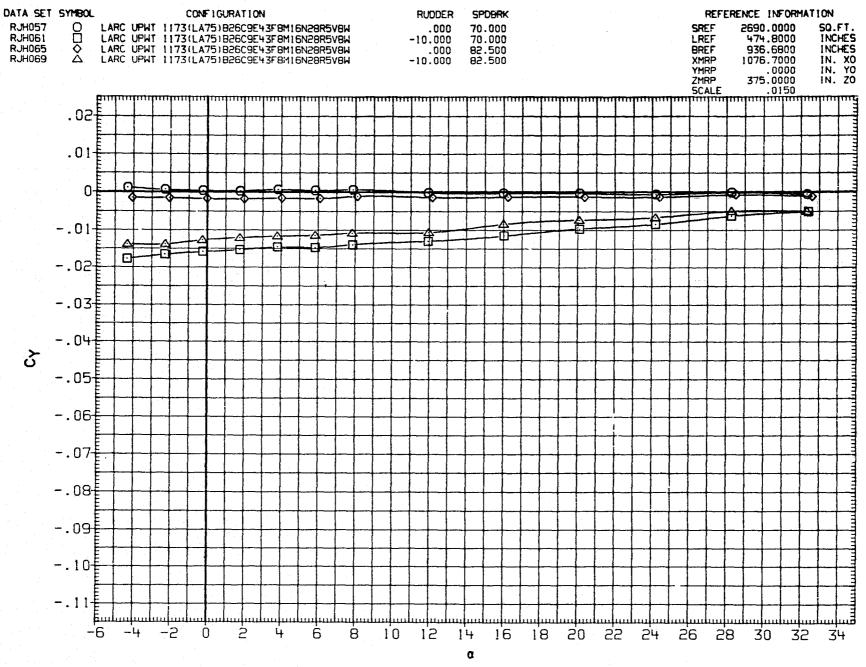
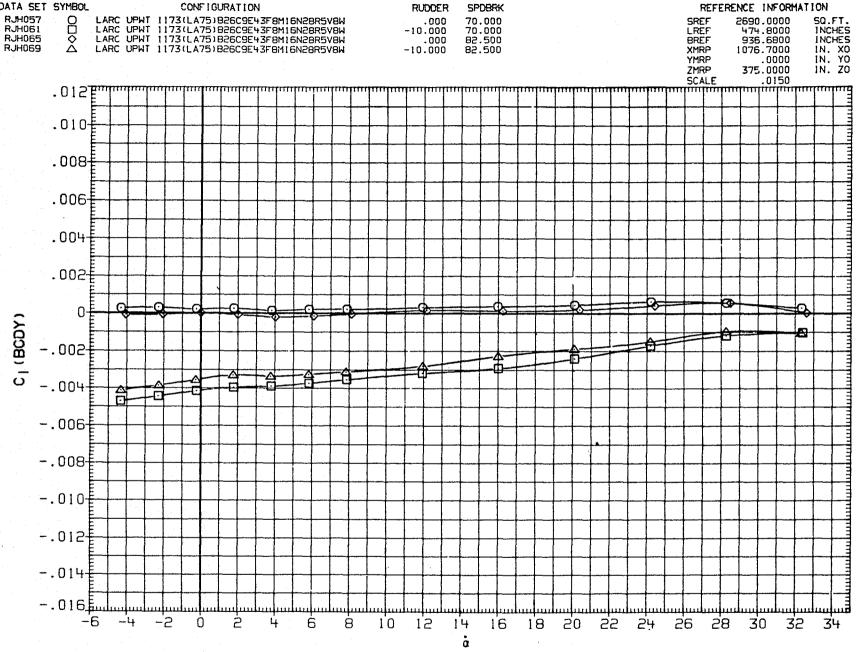


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS



SPDBRK

FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(A)MACH = 2.86

DATA SET SYMBOL

CONFIGURATION

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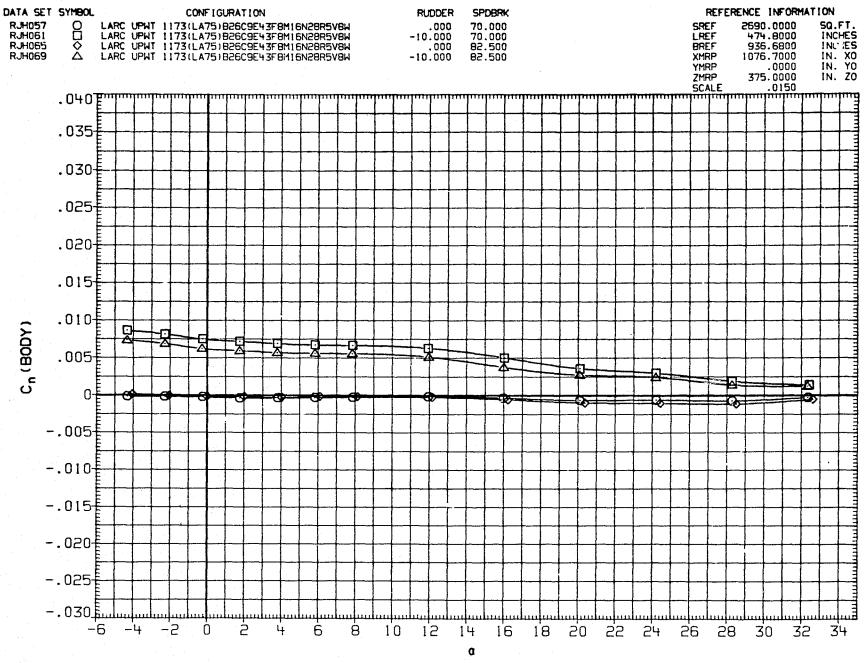
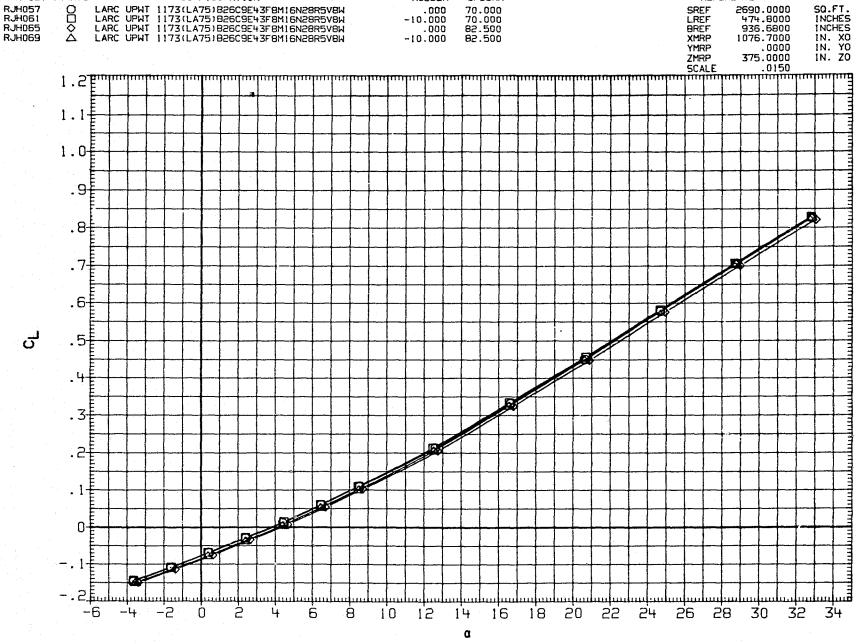


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS



RUDDER

SPDBRK

FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(B)MACH = 3.90

DATA SET SYMBOL

CONFIGURATION

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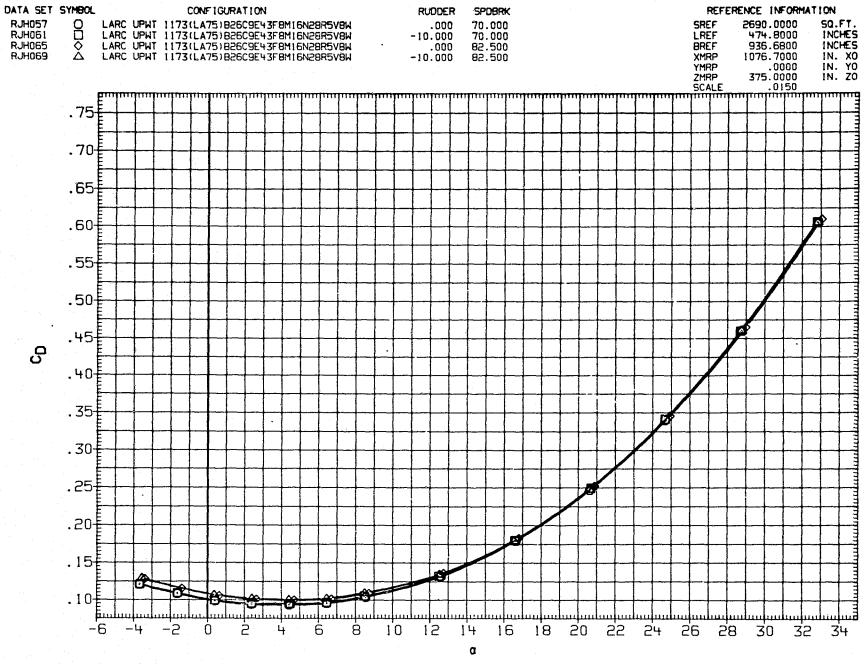


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

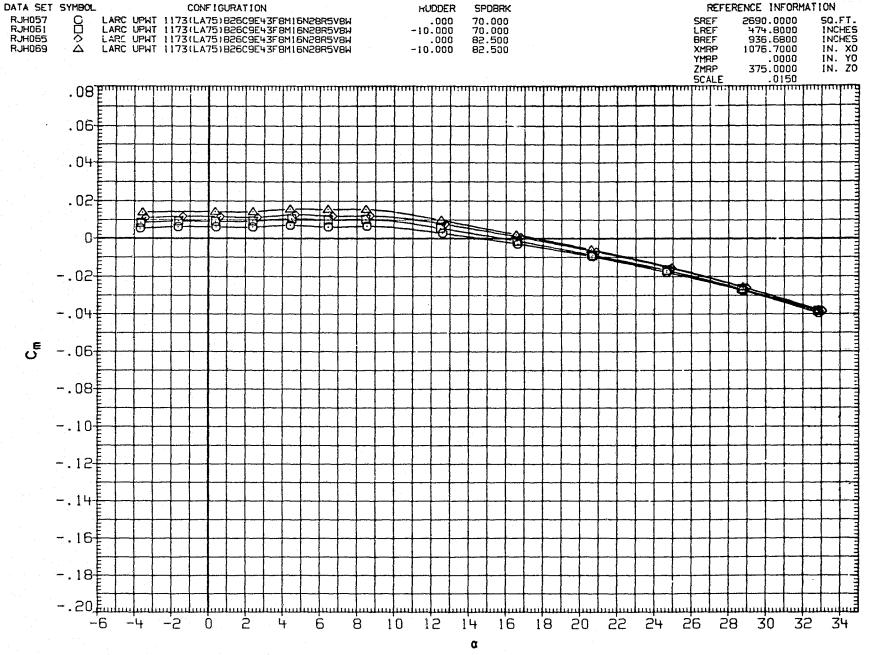


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

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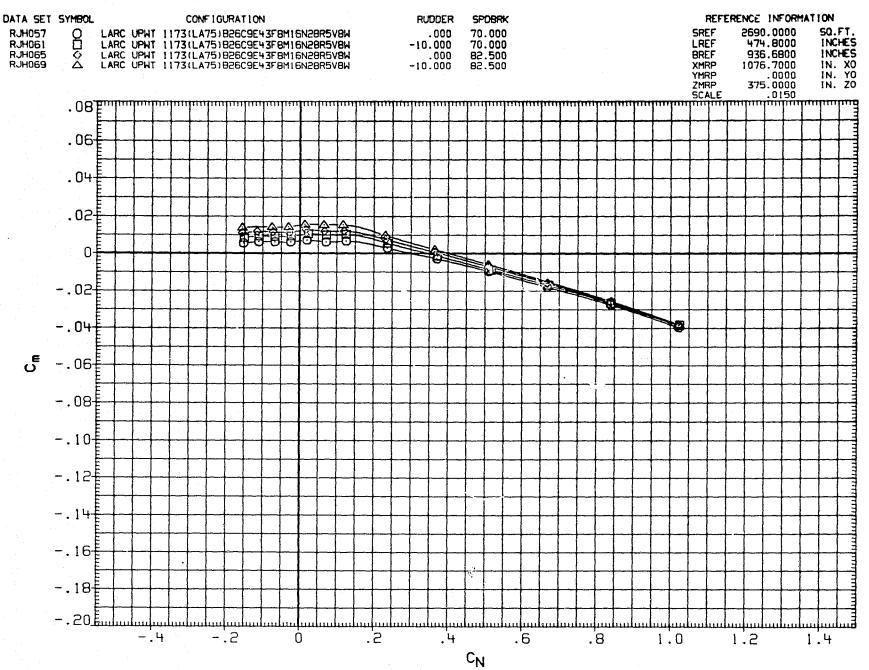


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

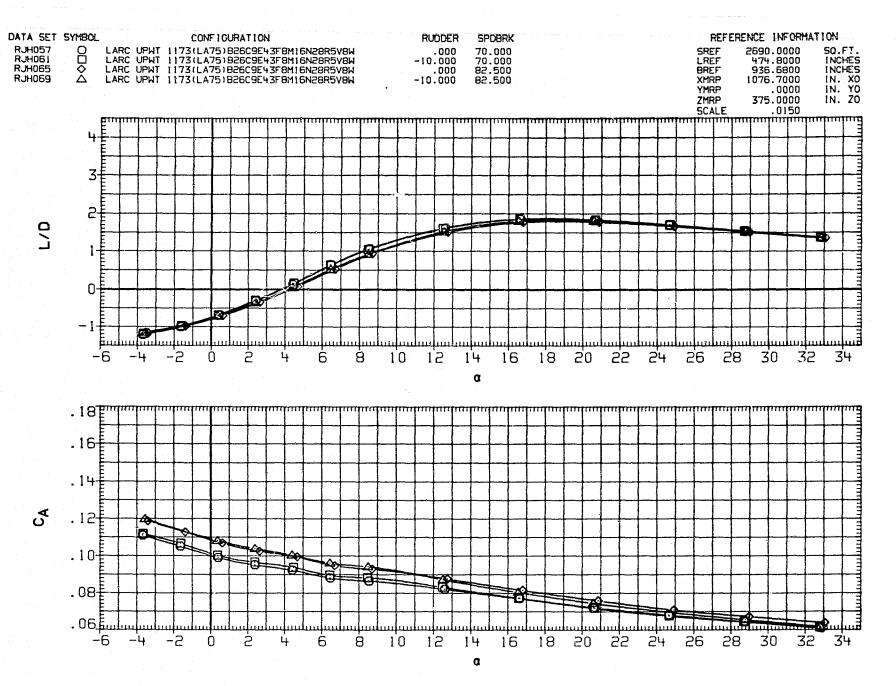


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

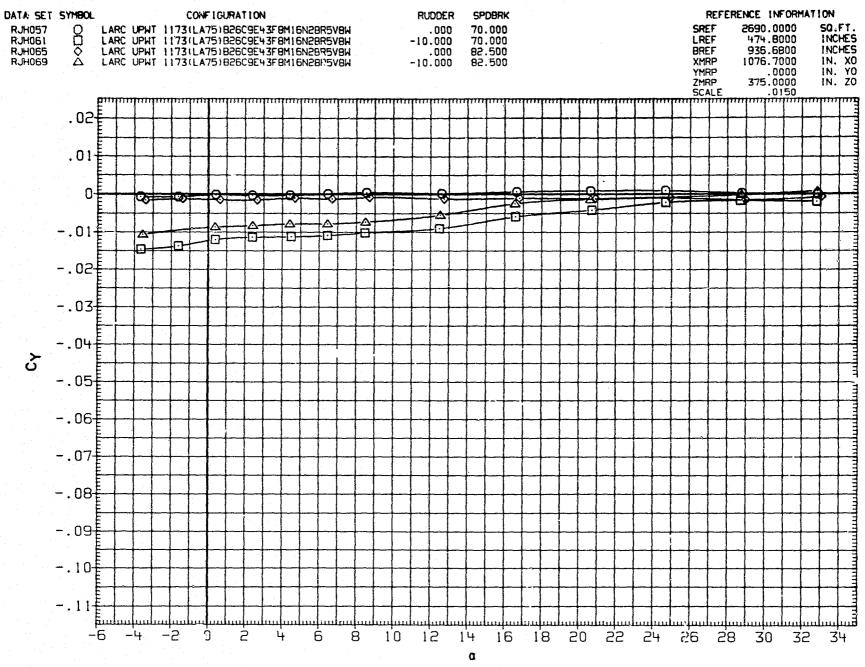


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

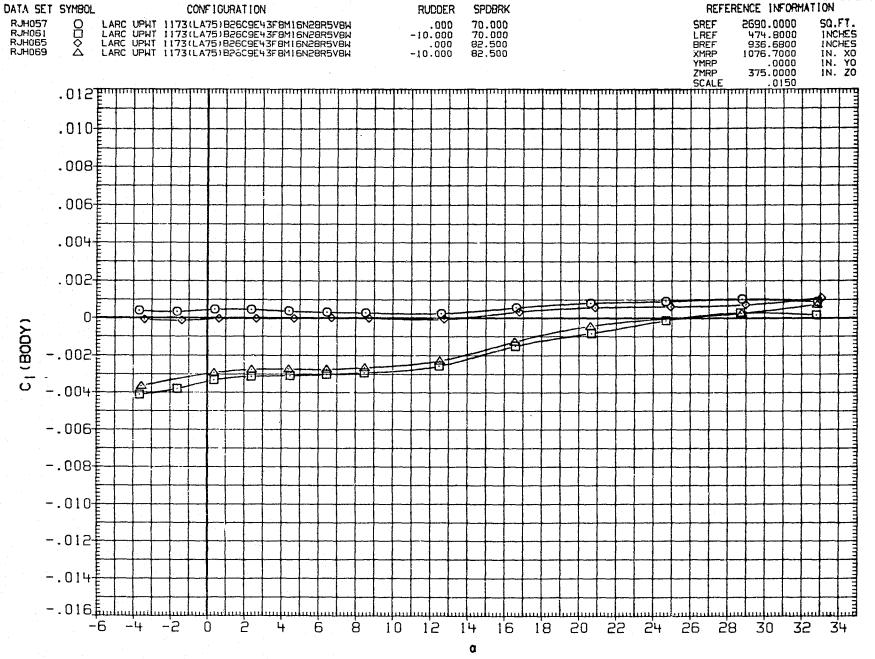
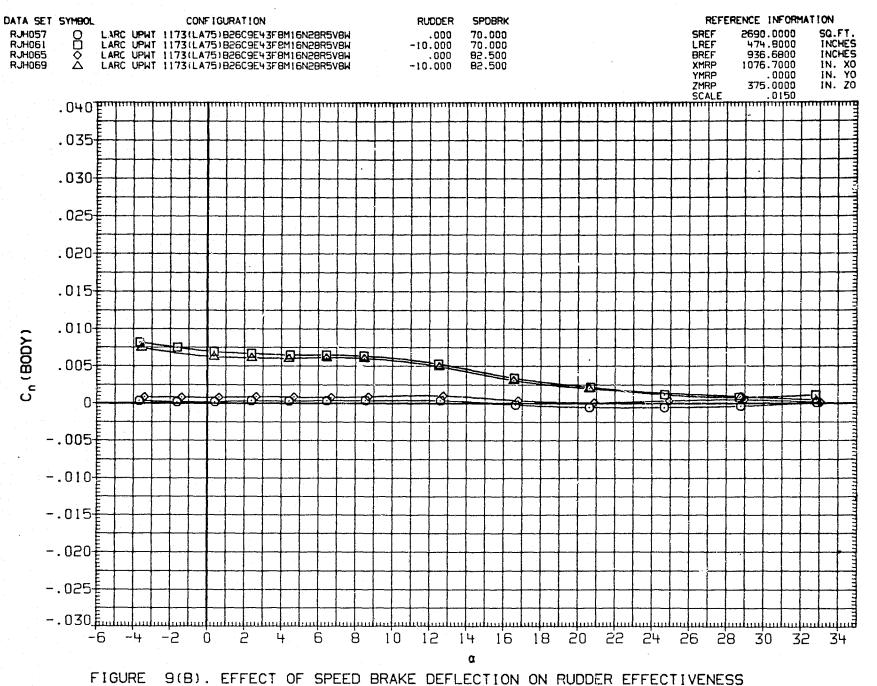
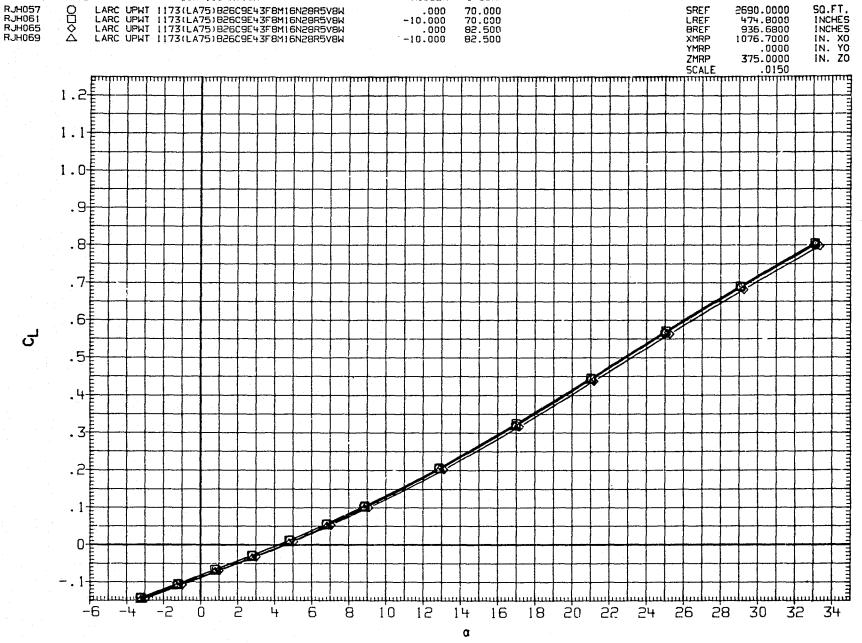


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS



PIGORE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON MUDDER EFFECTIVENES



RUDDER

SPOBRK

FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

DATA SET SYMBOL

CONFIGURATION

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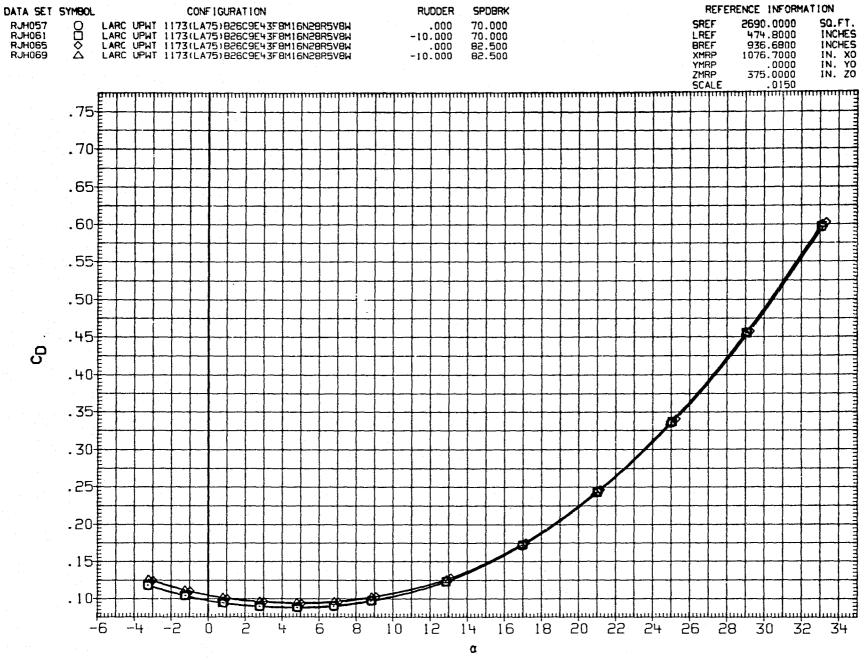
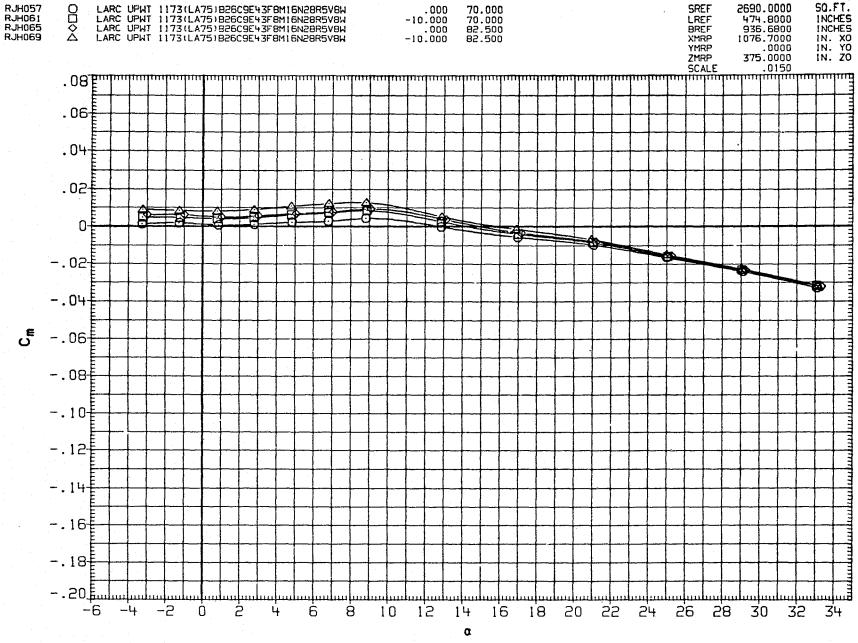


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

 $(C)^{MACH} = 4.60$ 



RUDDER

SPOBRK

FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

DATA SET SYMBOL

CONFIGURATION

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REFERENCE INFORMATION

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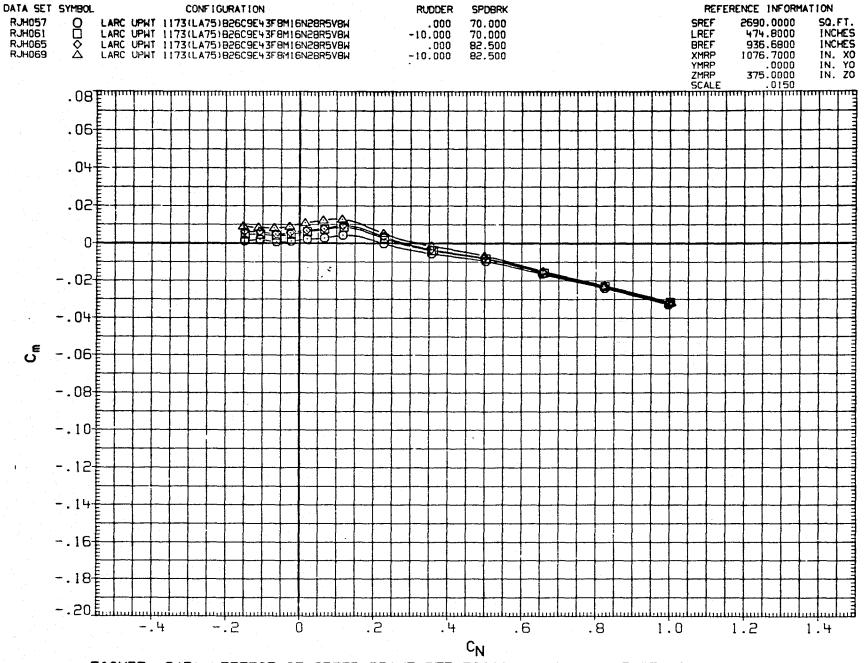


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

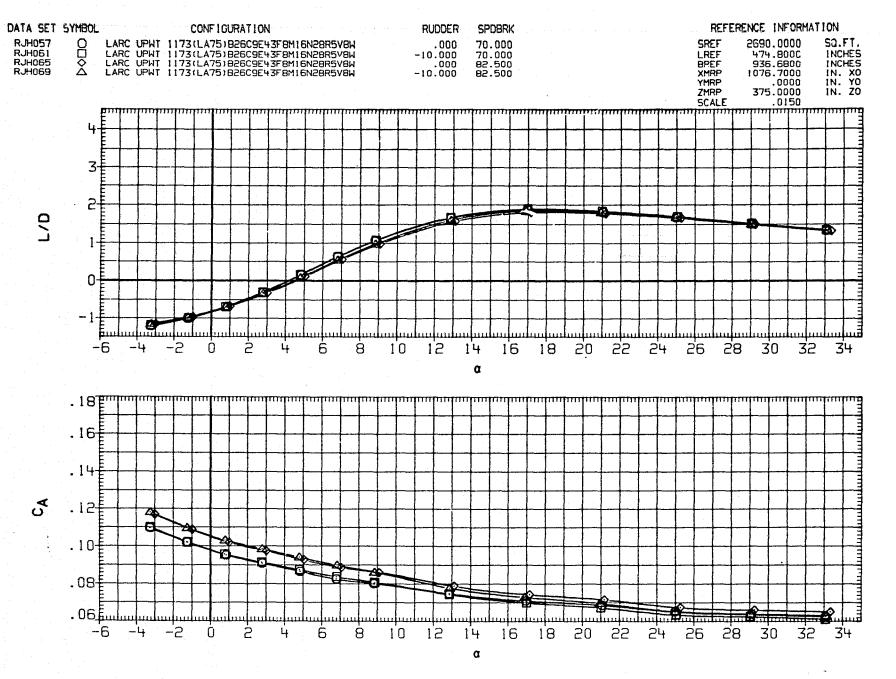


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS (C)MACH = 4.60

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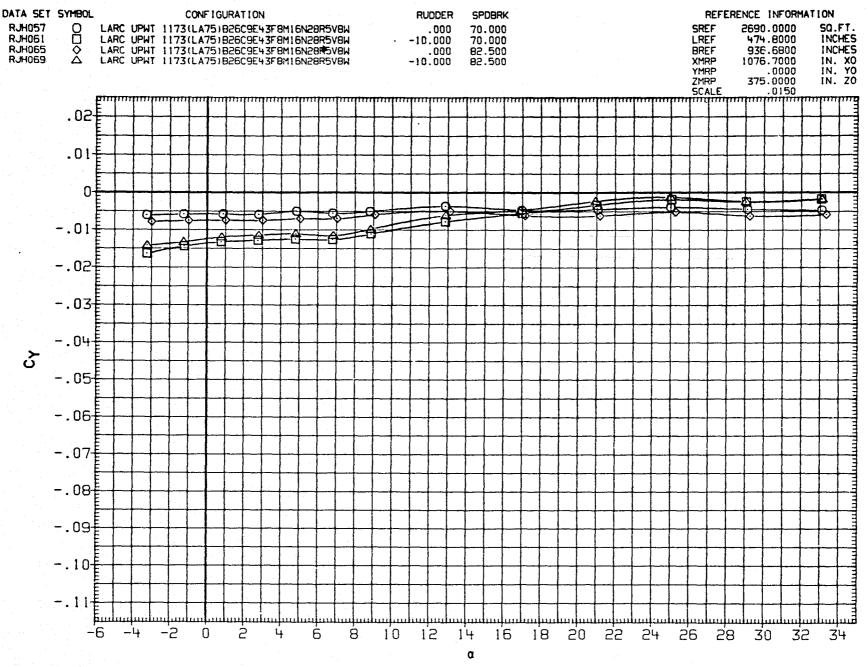


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

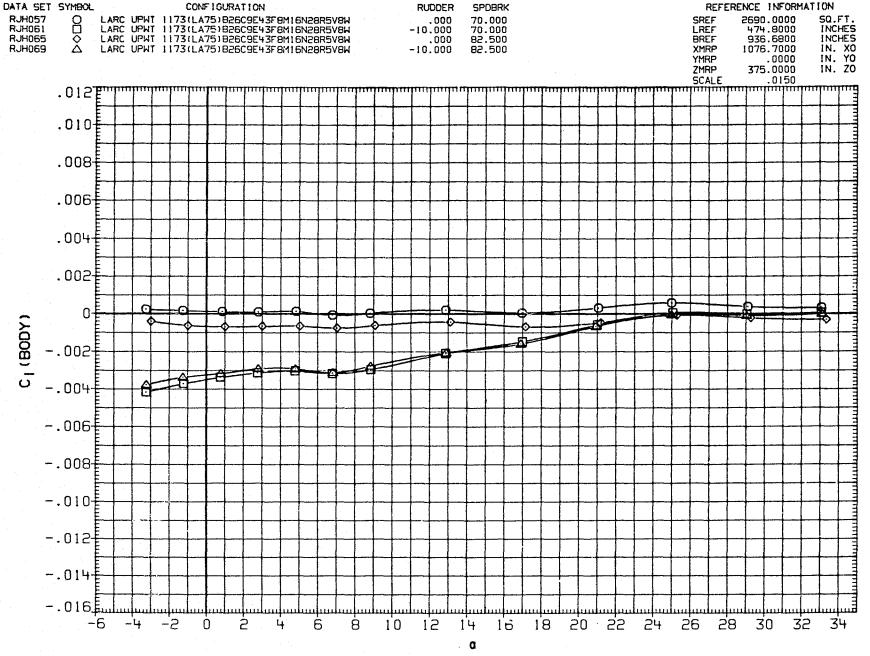


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

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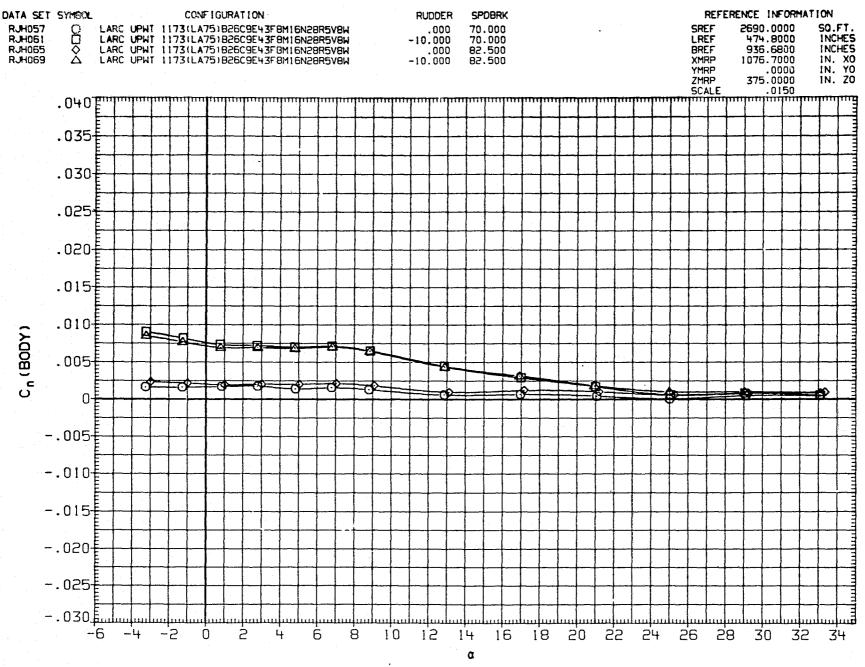


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH =

4.60

195

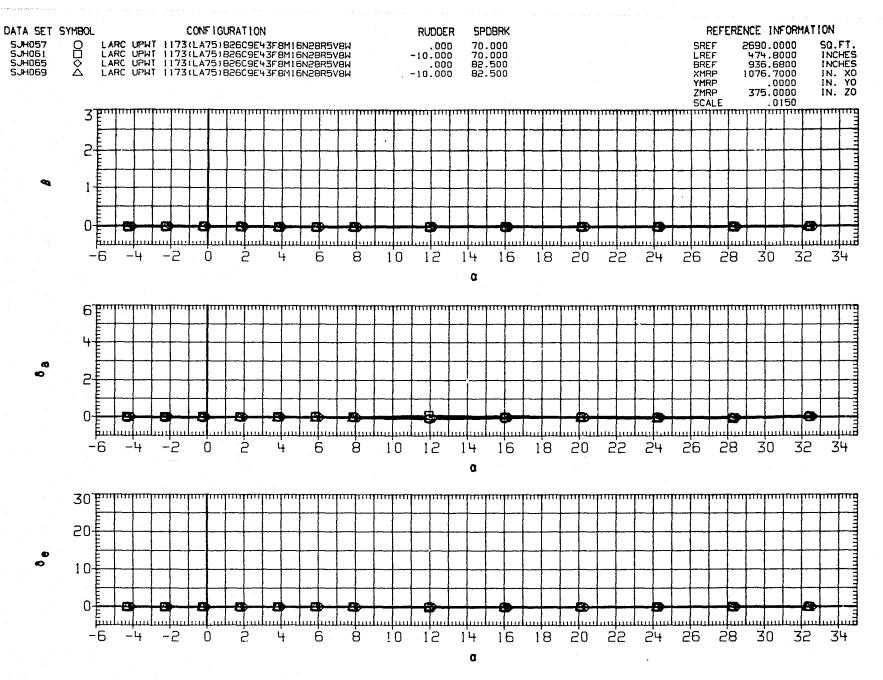


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

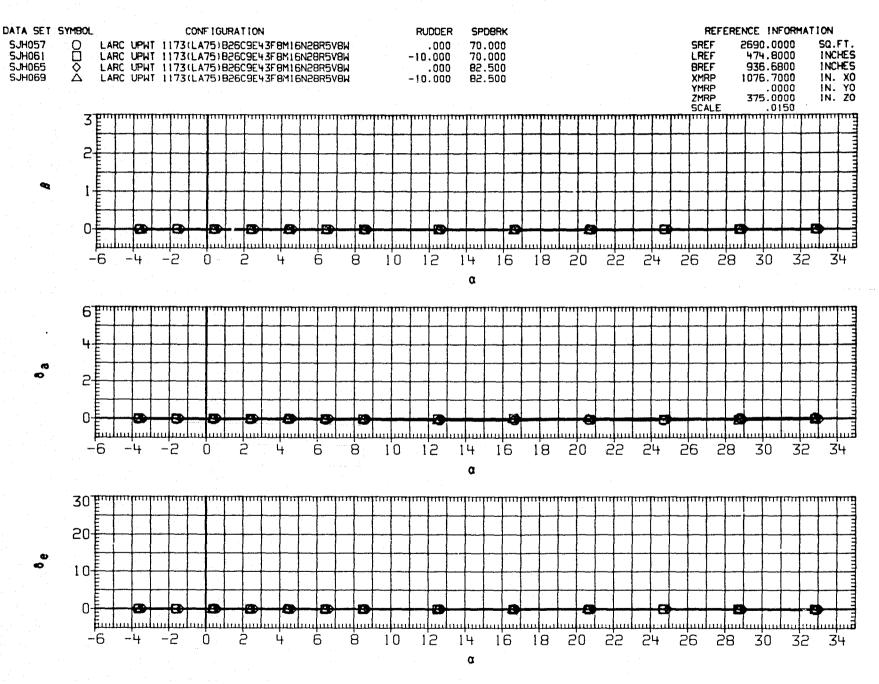


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

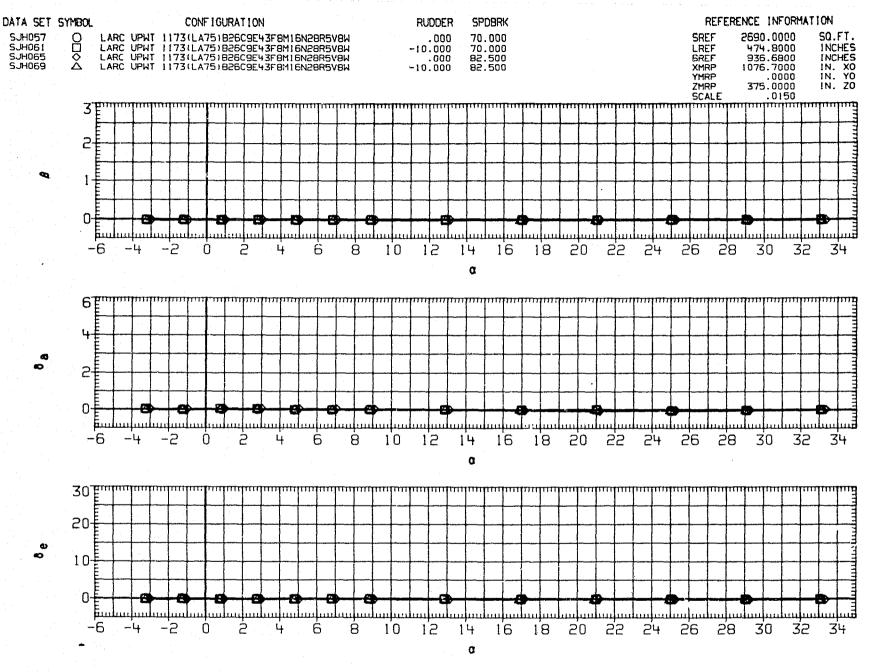


FIGURE 9(B). EFFECT OF SPEED BRAKE DEFLECTION ON RUDDER EFFECTIVENESS

(C)MACH = 4.60

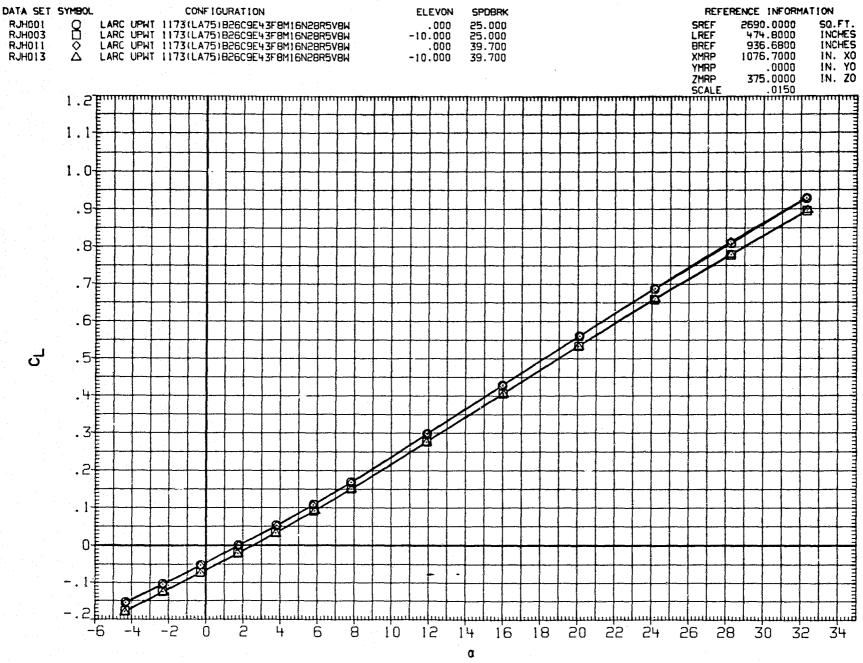


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

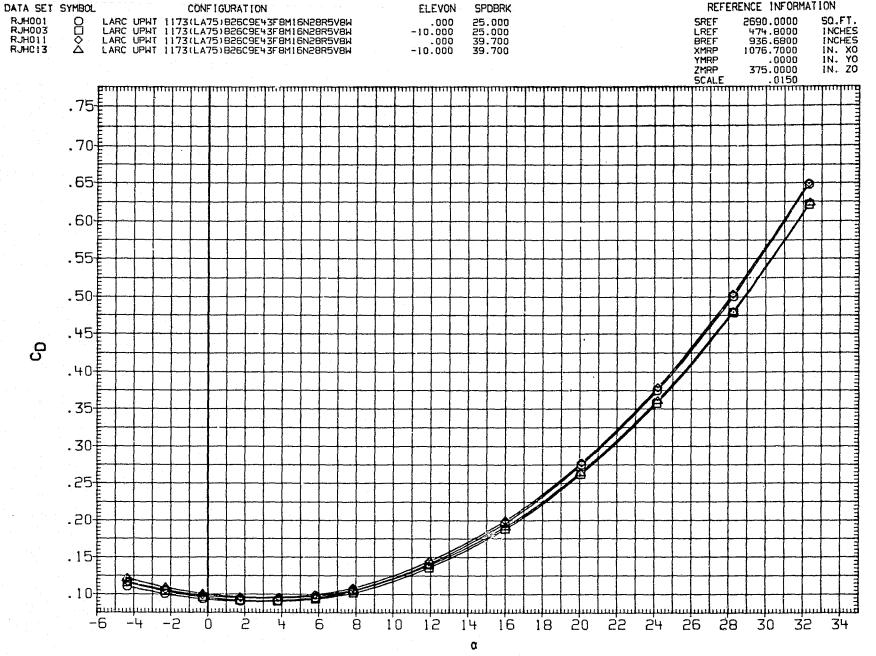


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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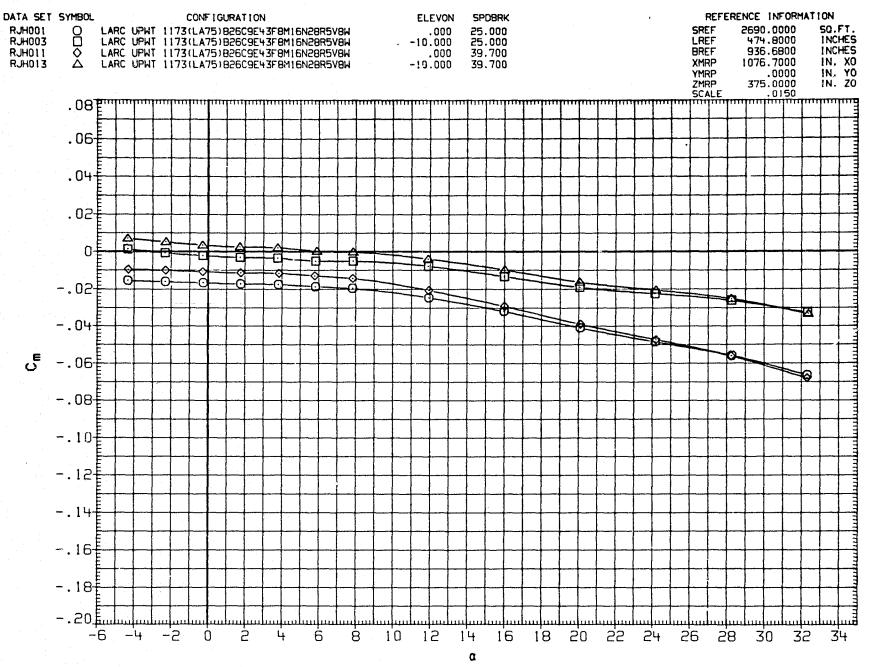


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

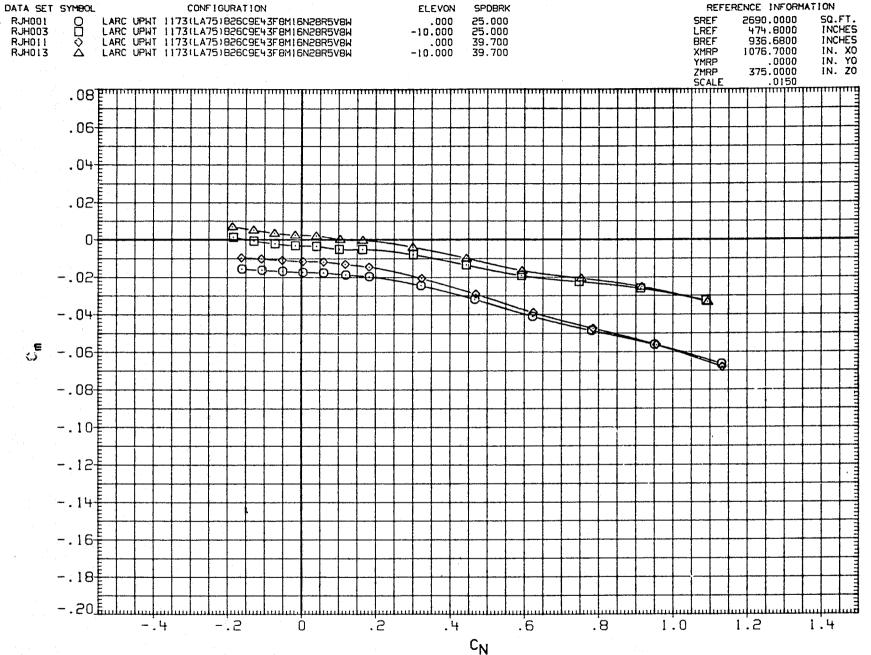


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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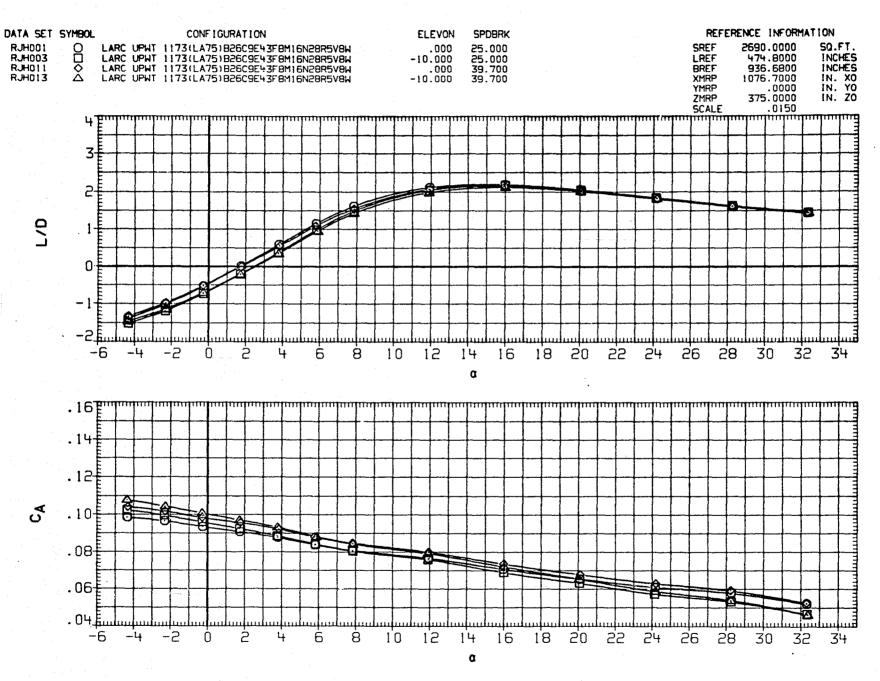


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

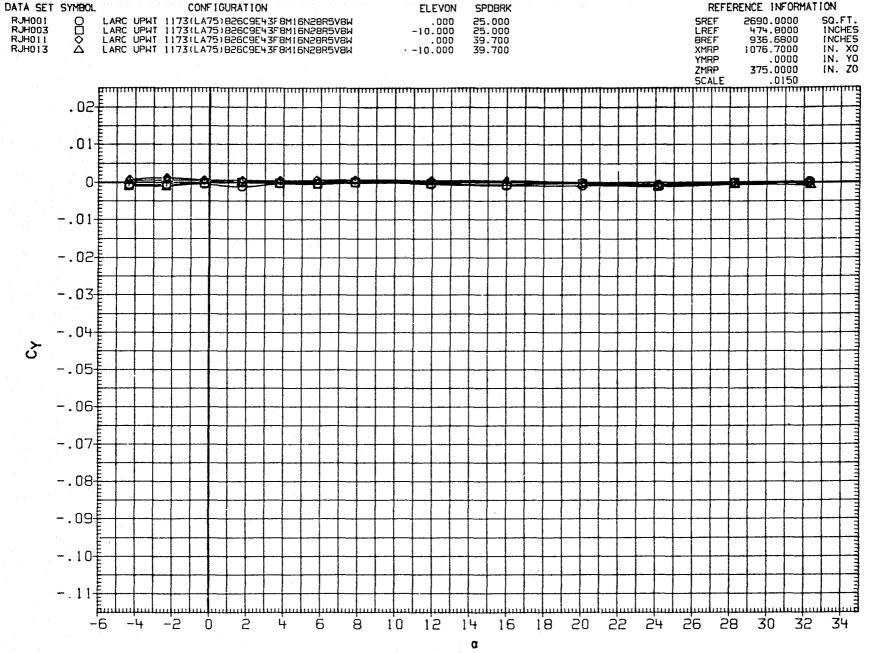


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

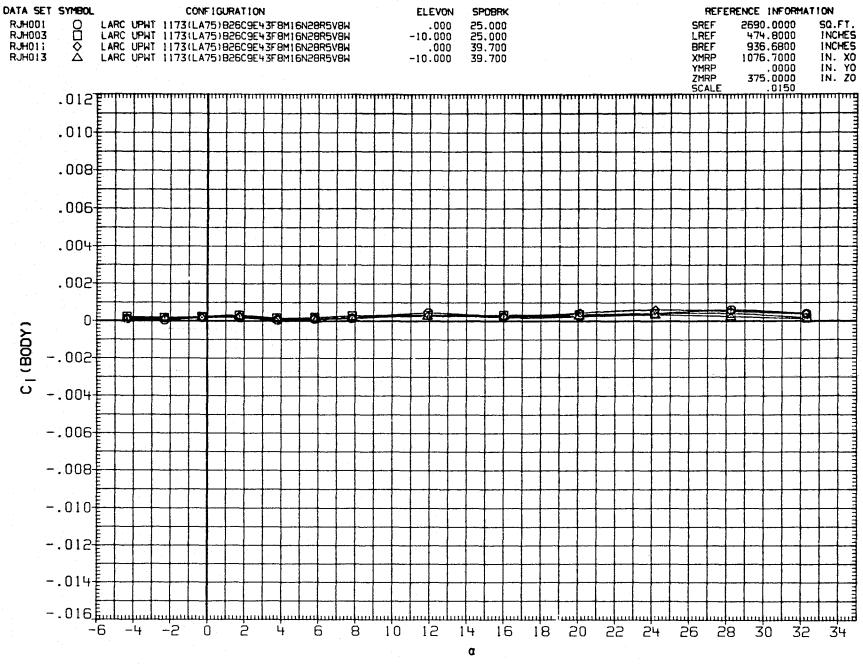


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

 $\cdot (A)MACH = 2.86$ 

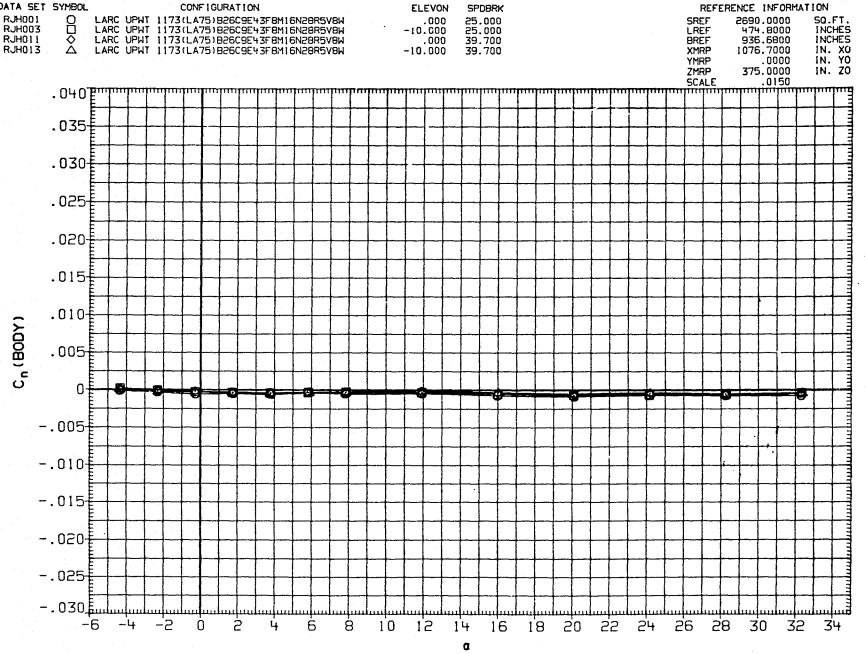
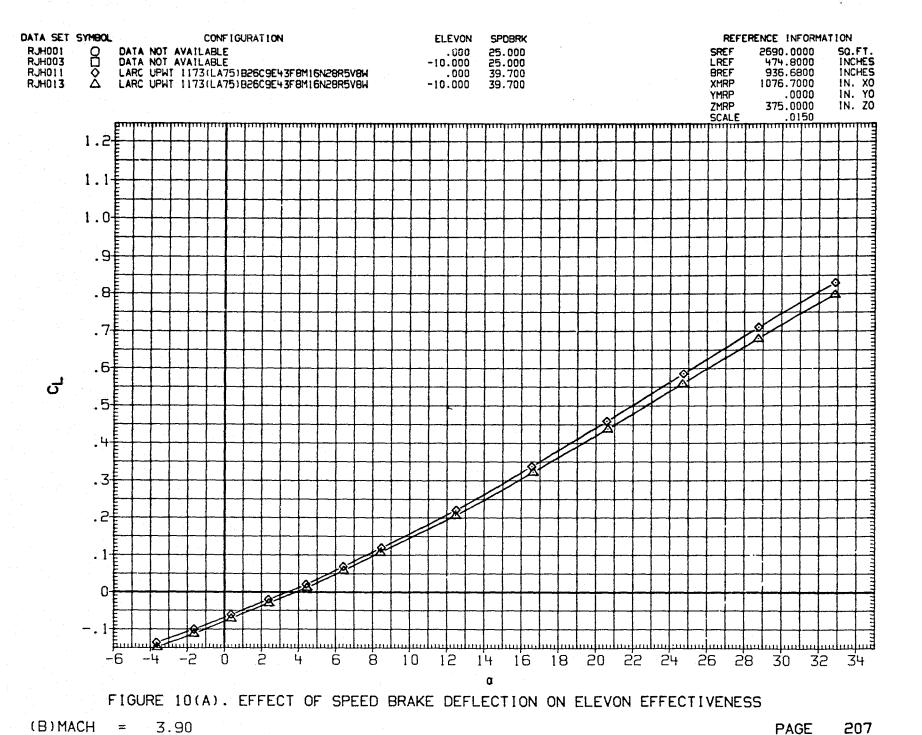


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

DATA SET SYMBOL



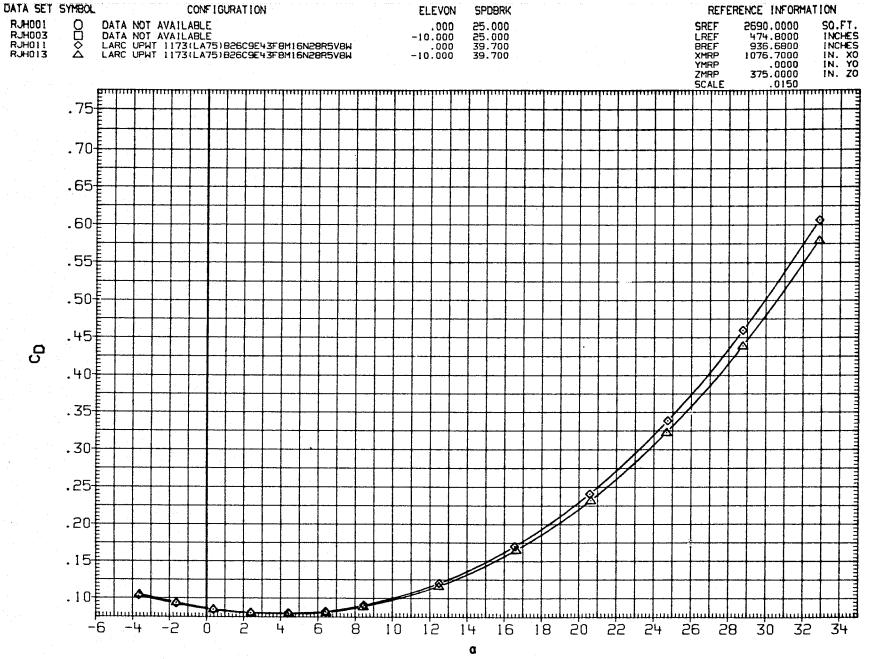


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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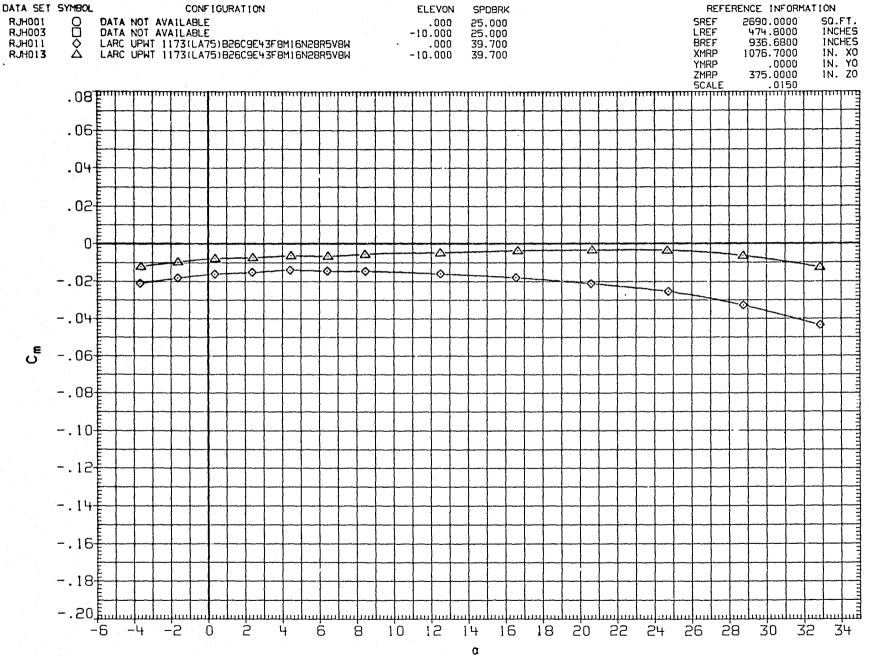


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

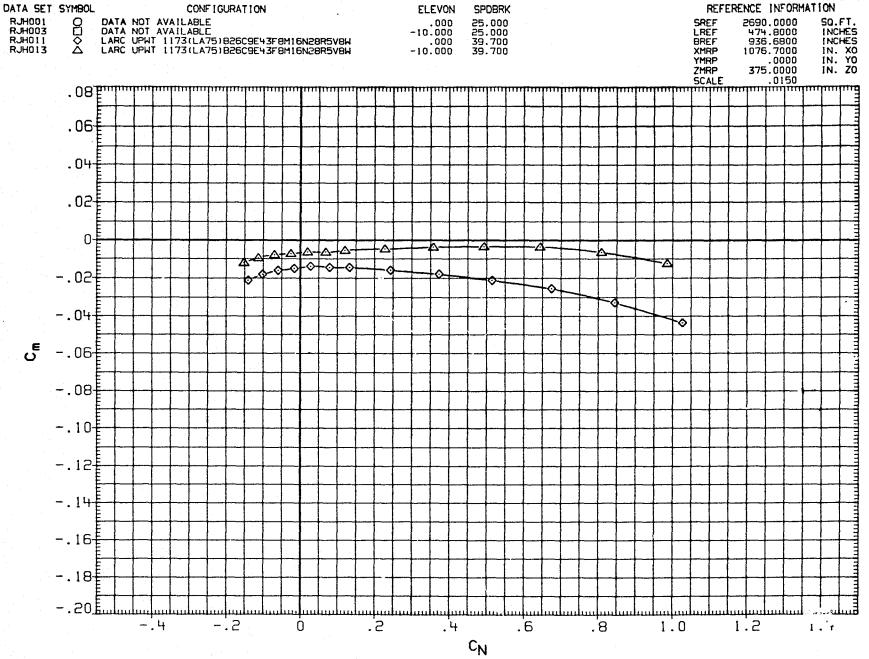


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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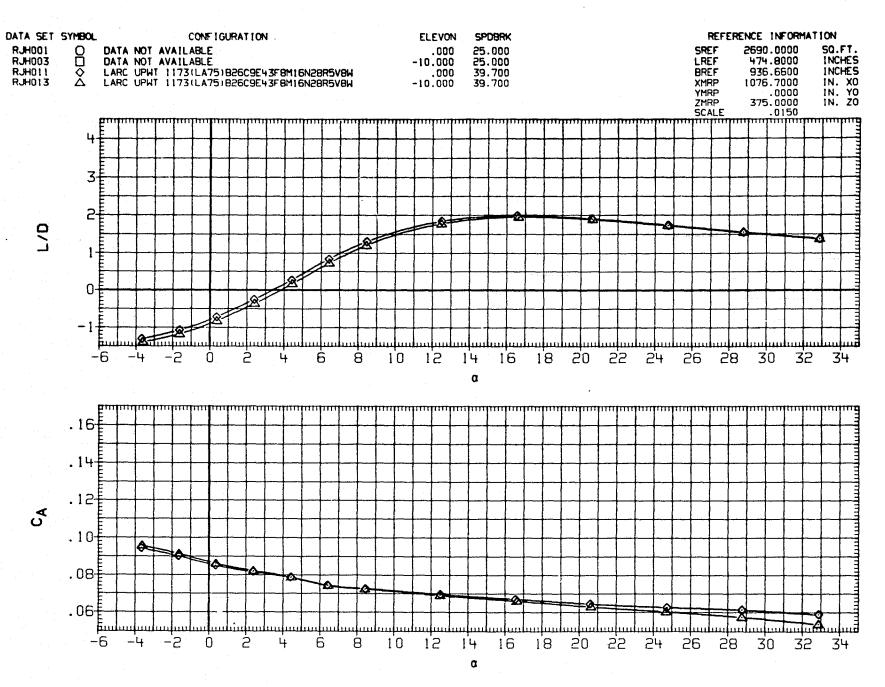


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

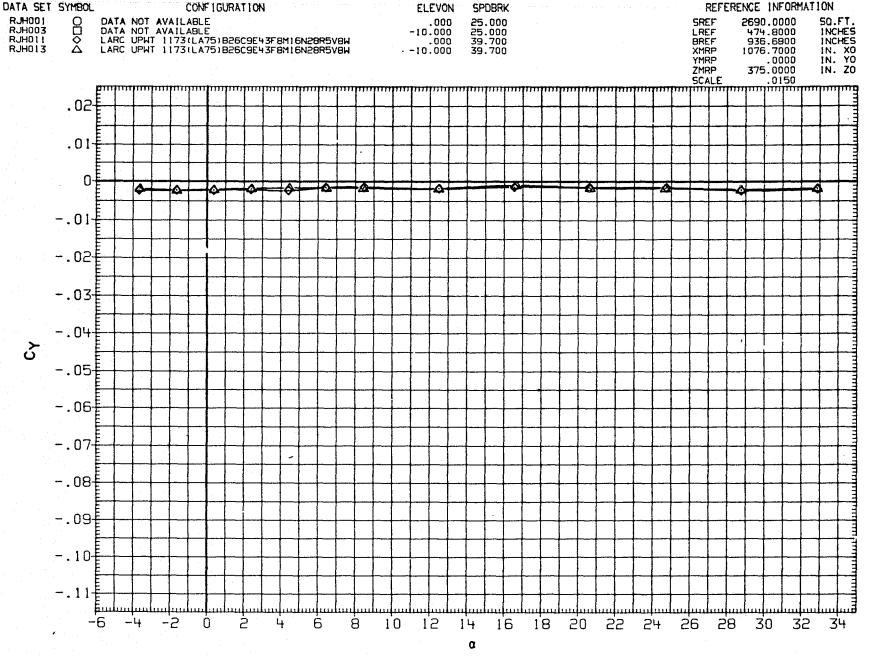


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

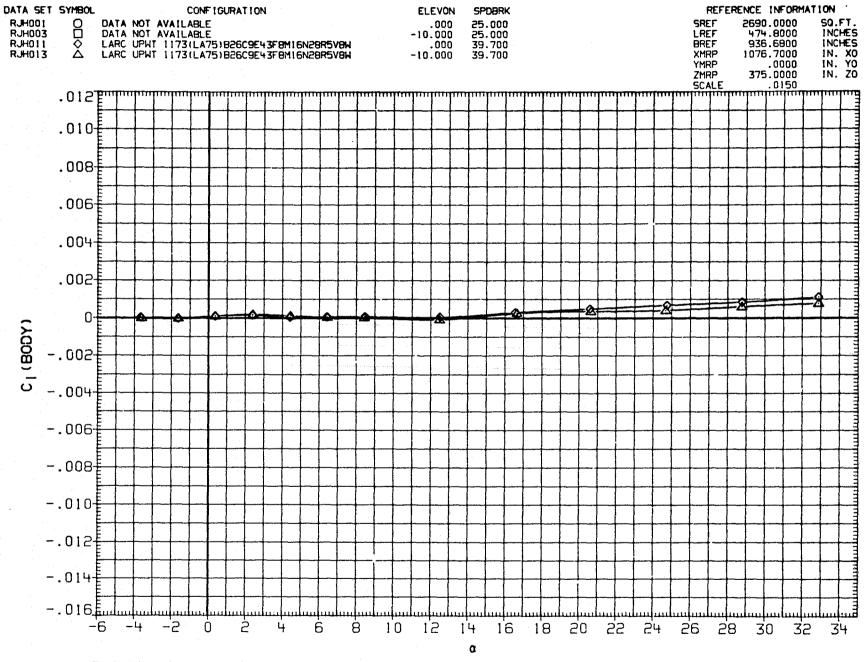


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

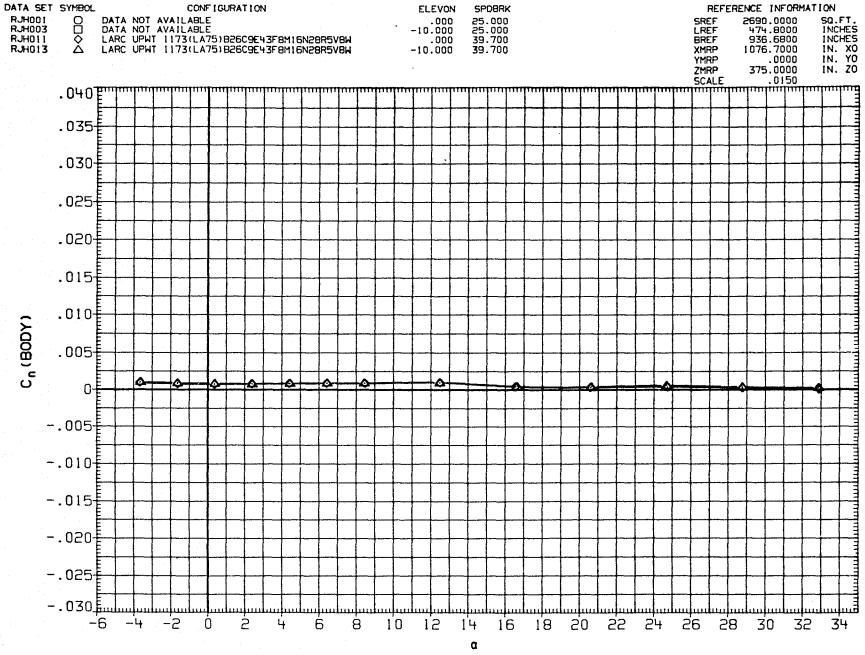


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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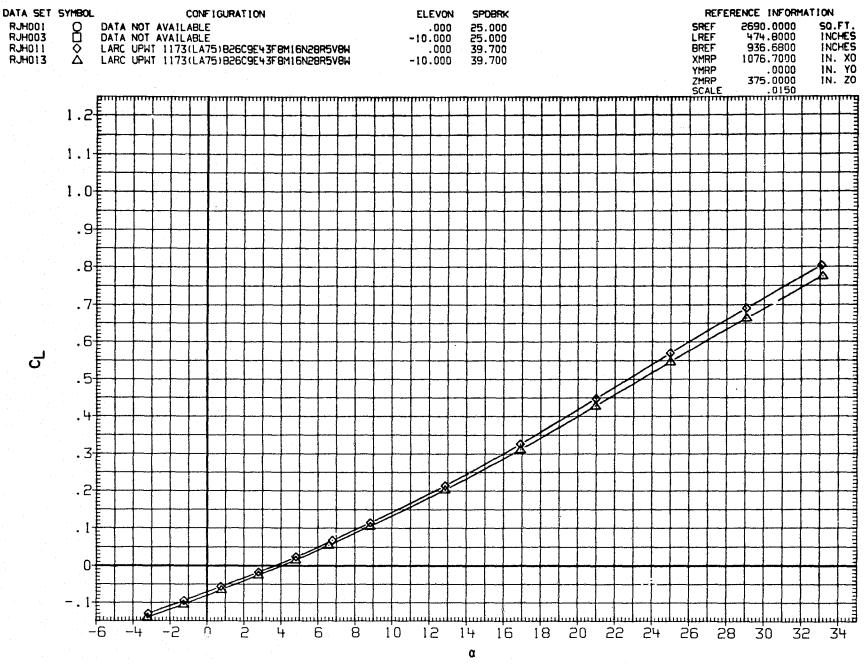


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

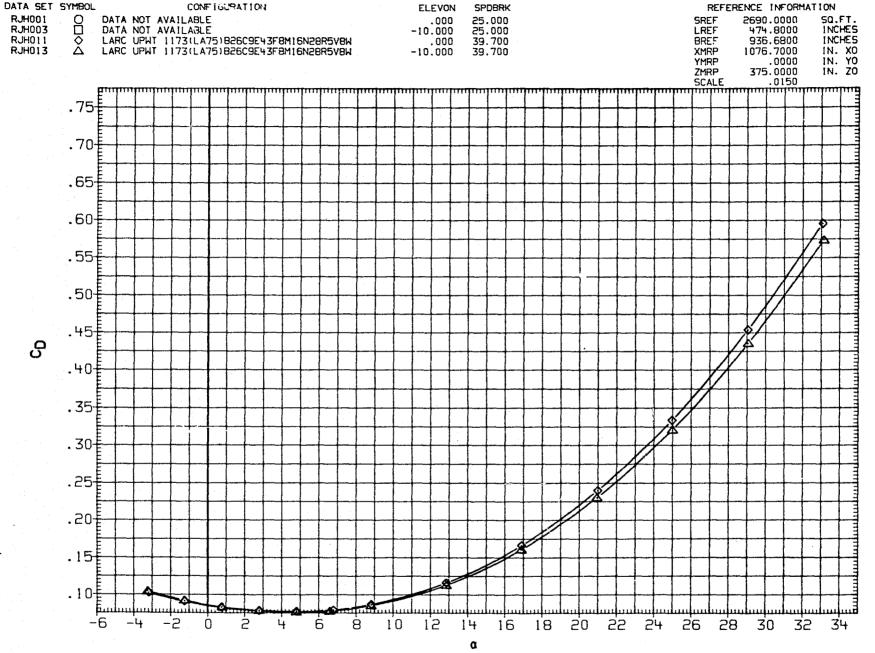


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

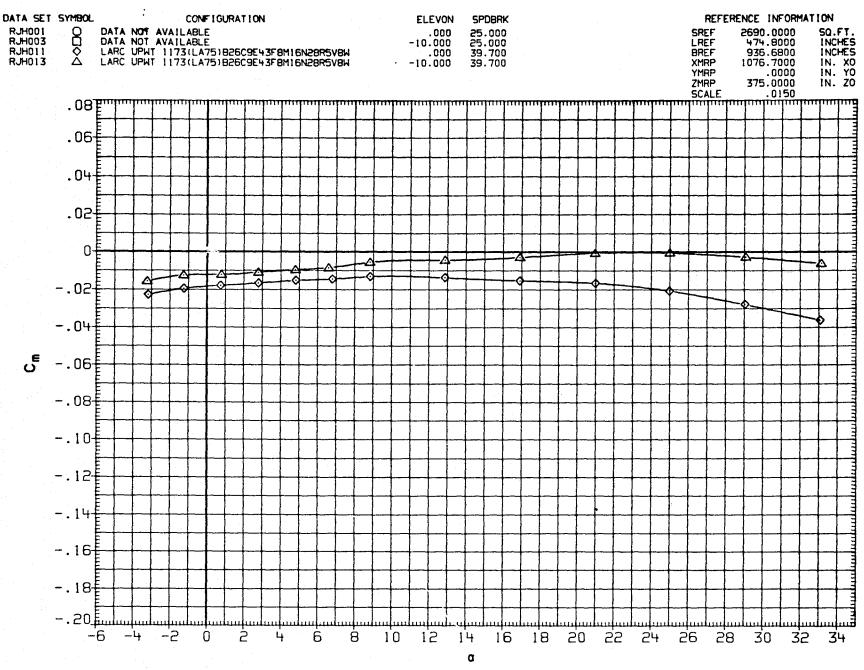


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

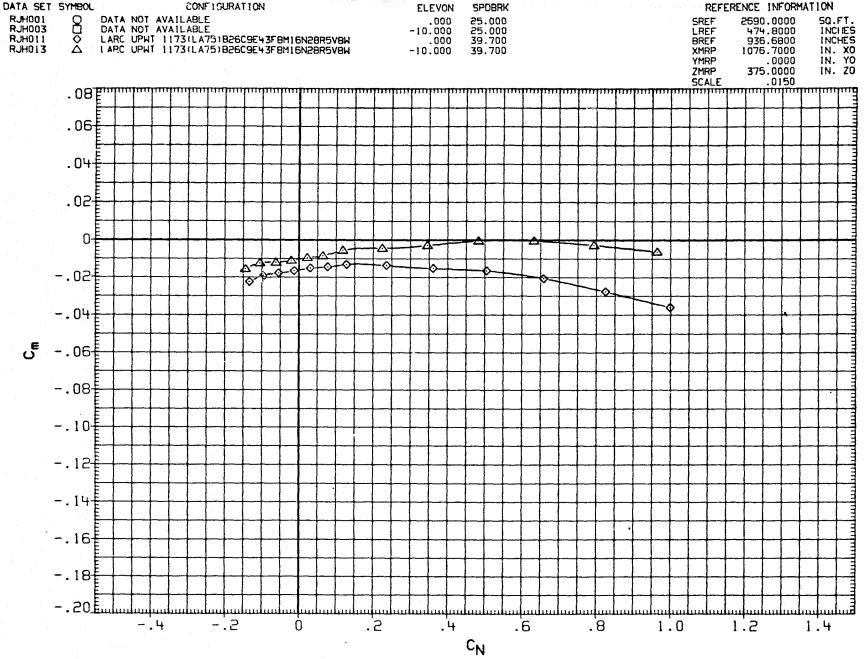


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

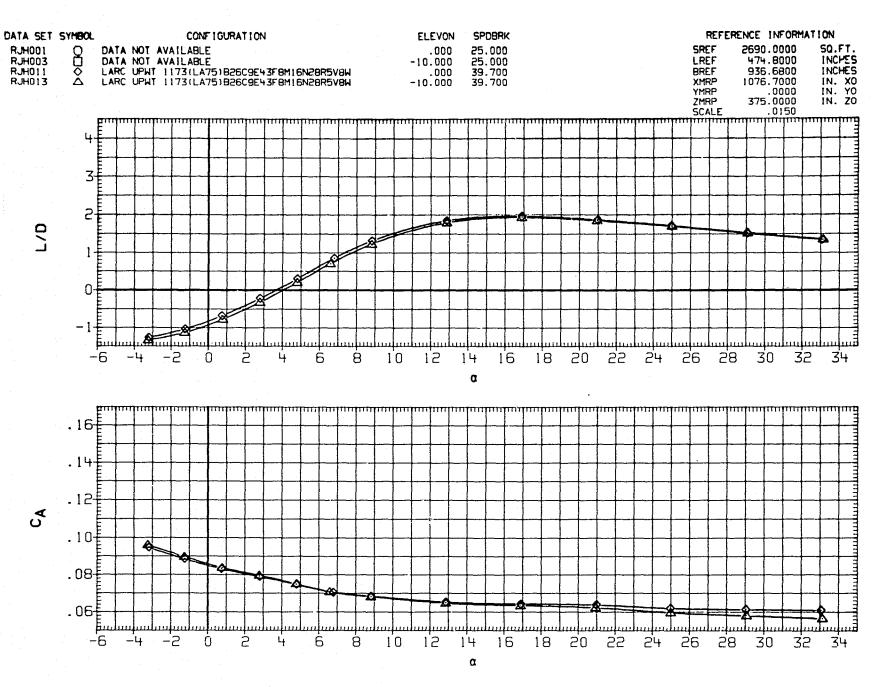


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

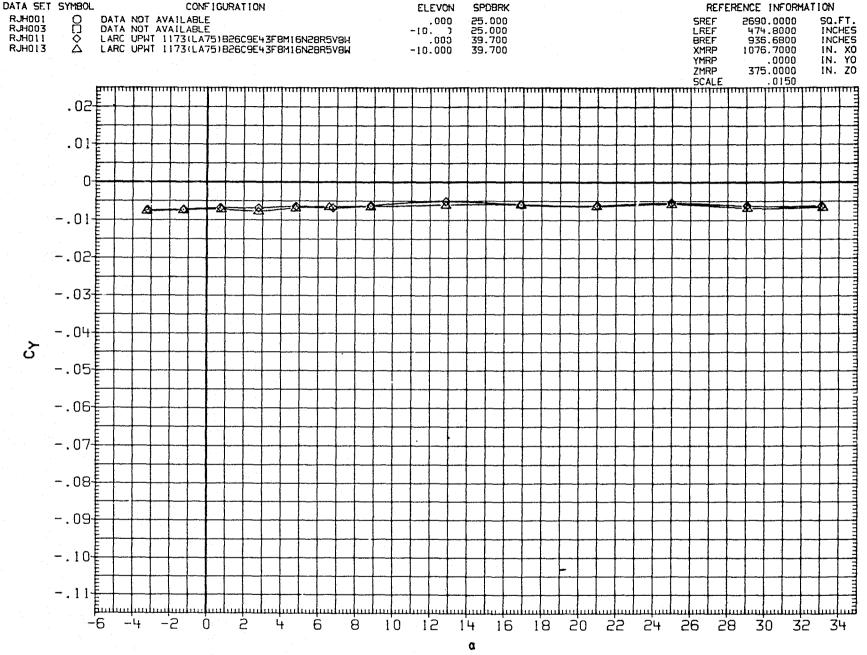


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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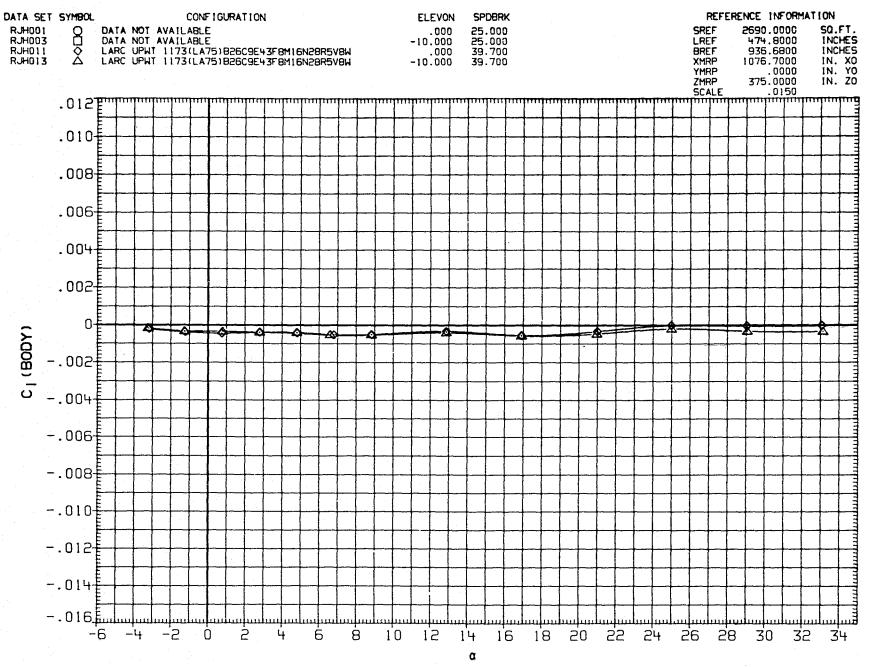


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

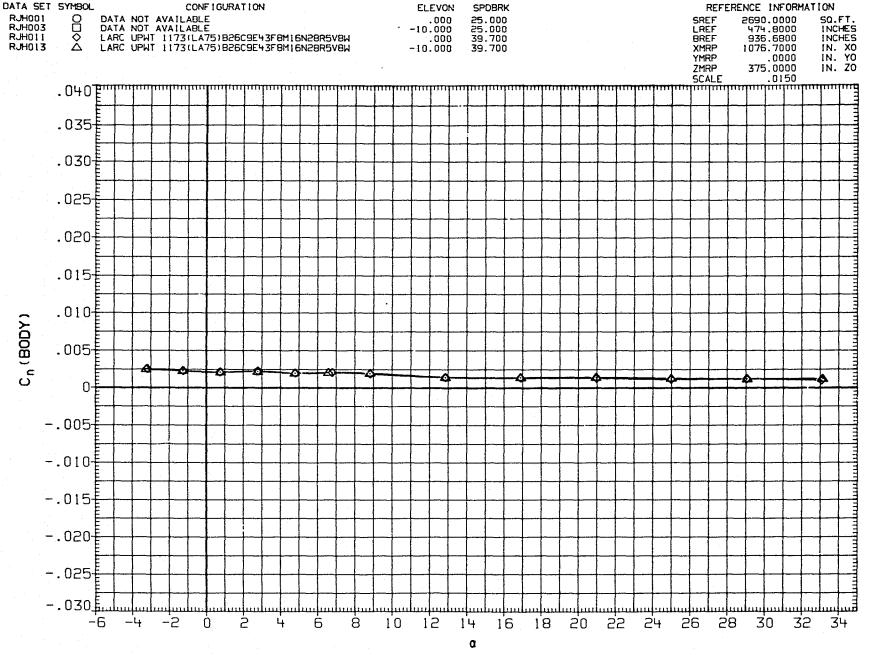


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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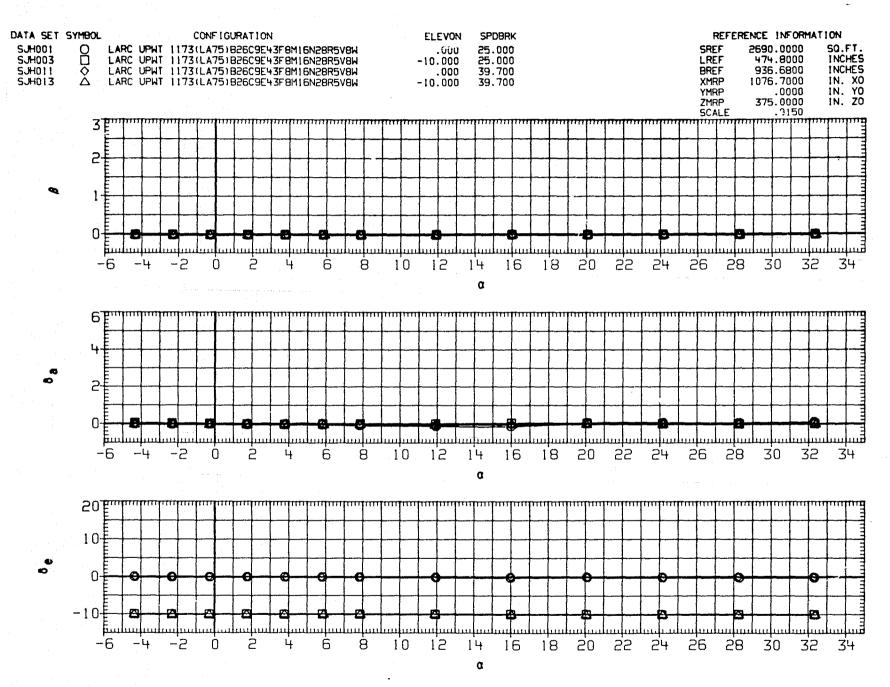


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

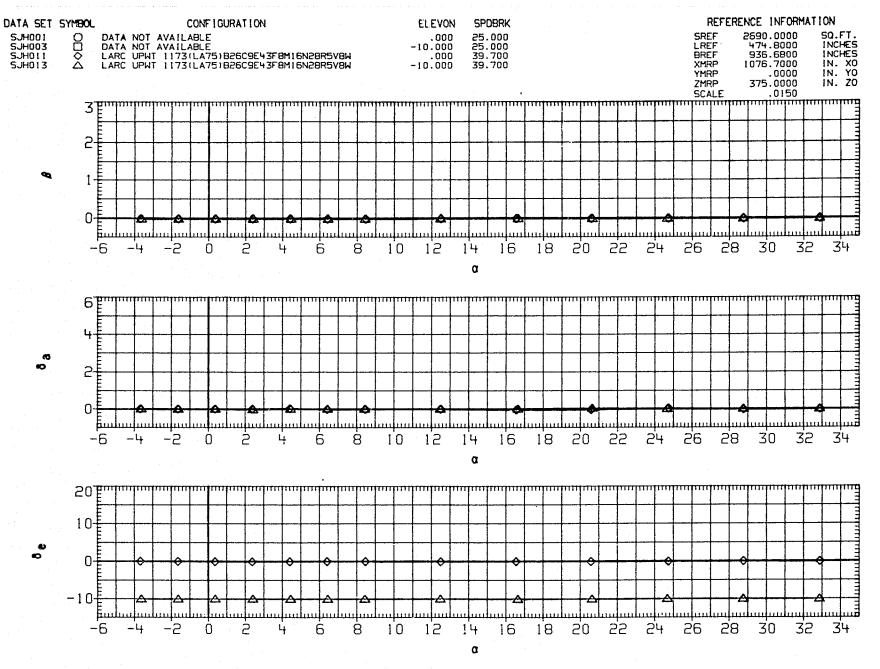


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

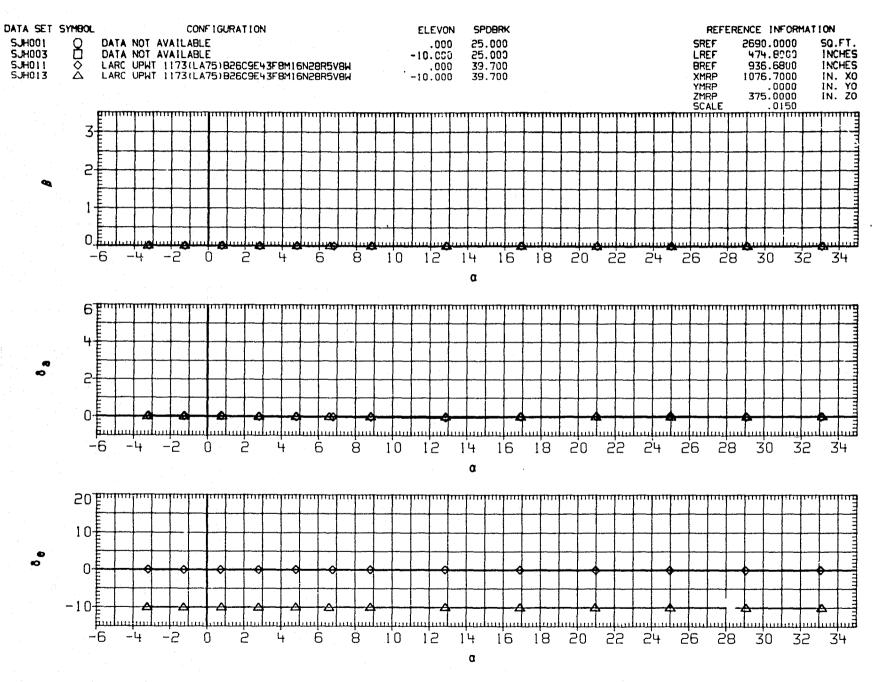


FIGURE 10(A). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

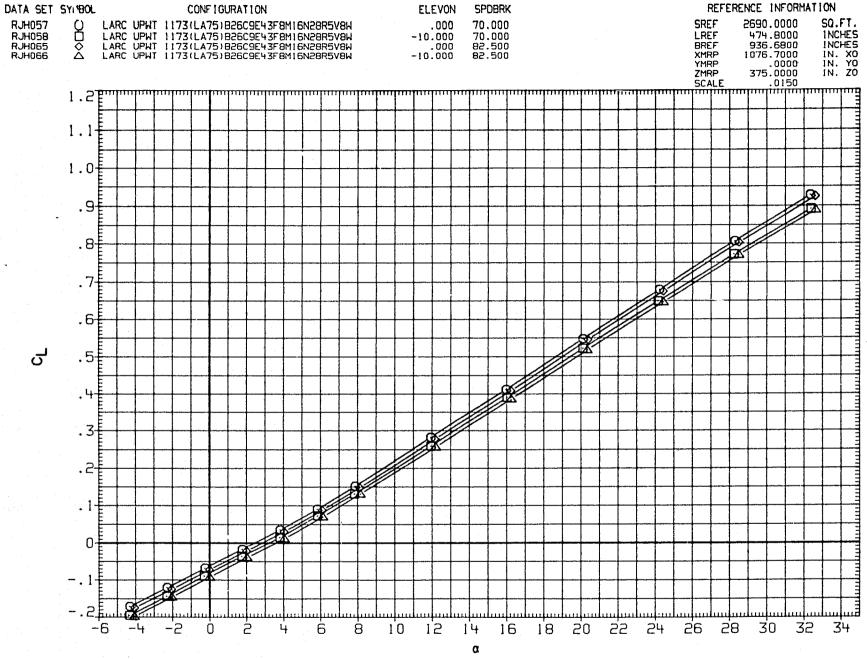


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

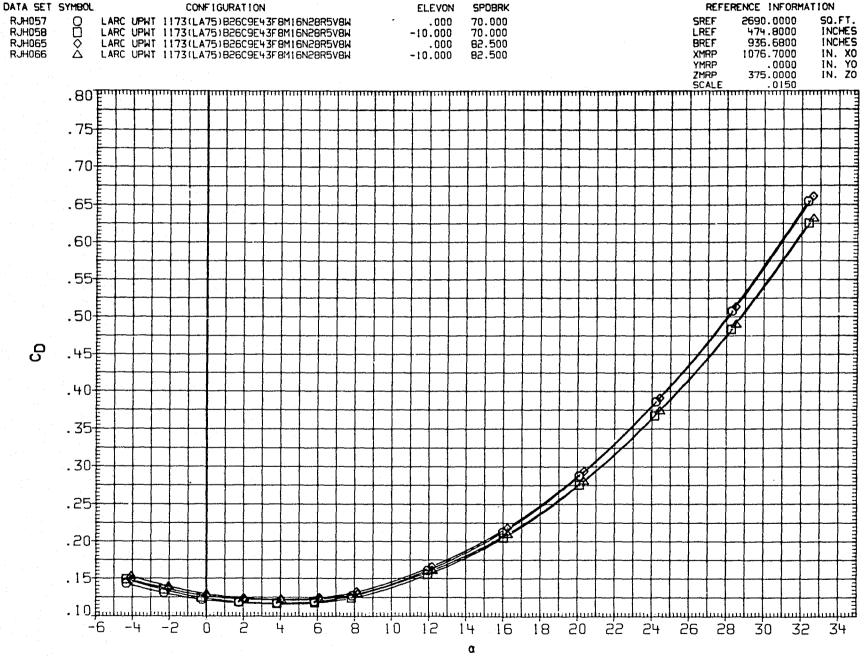


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

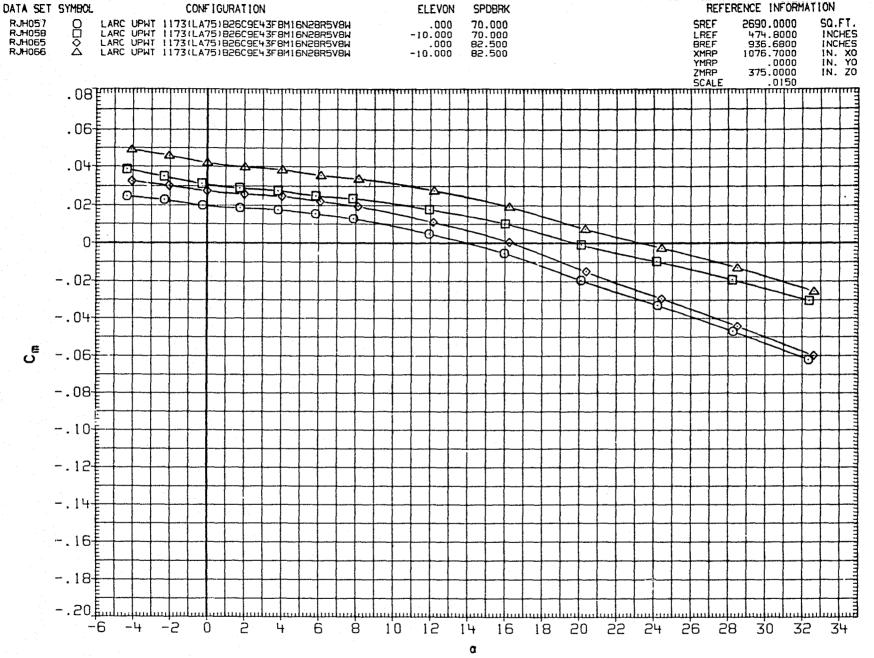


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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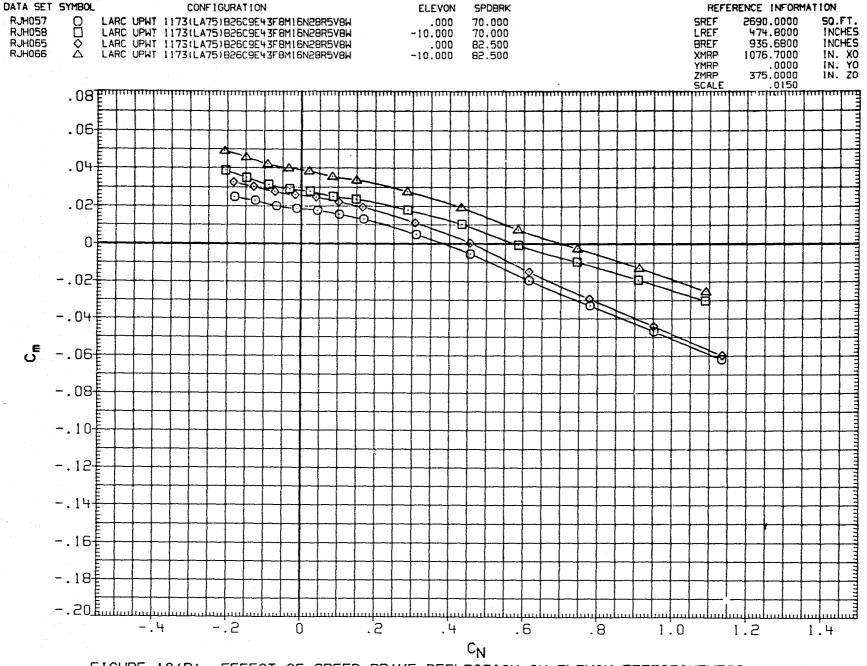


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

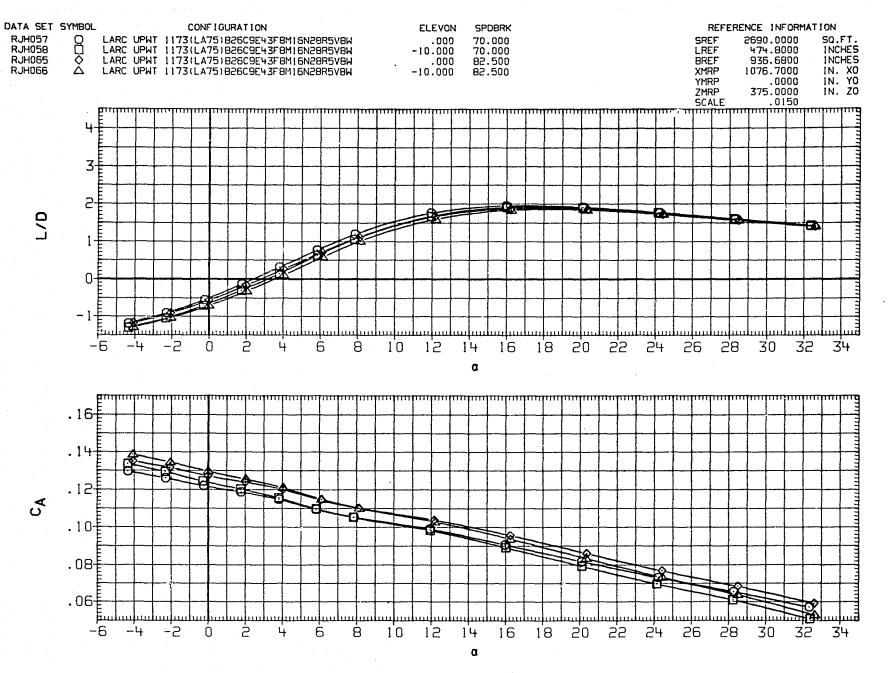


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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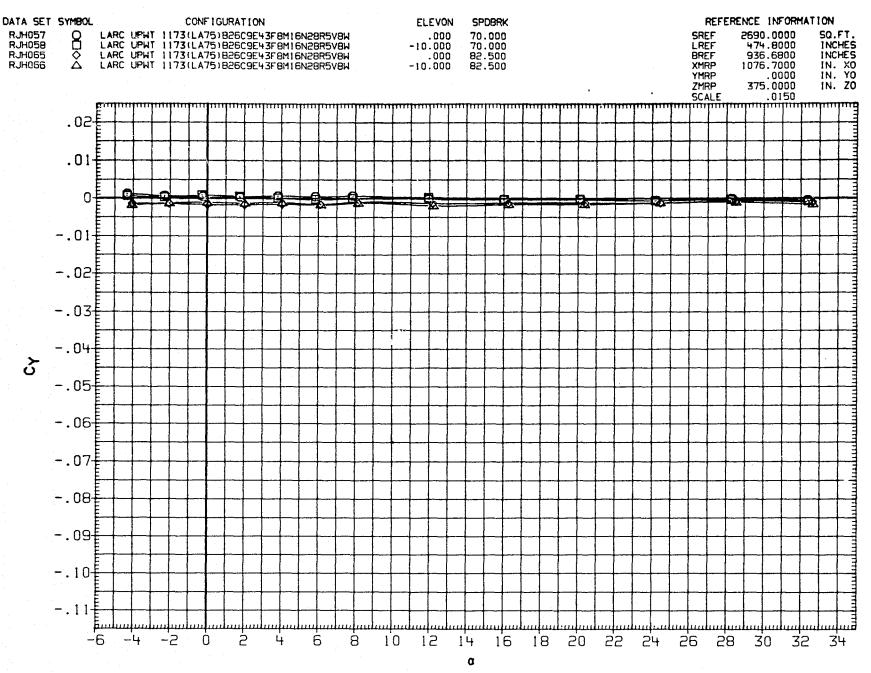


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

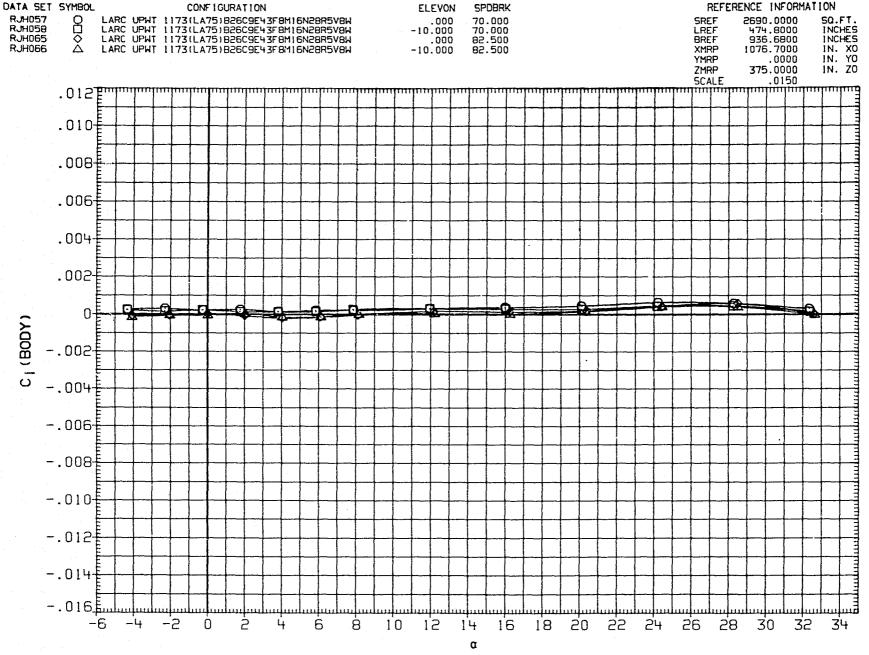


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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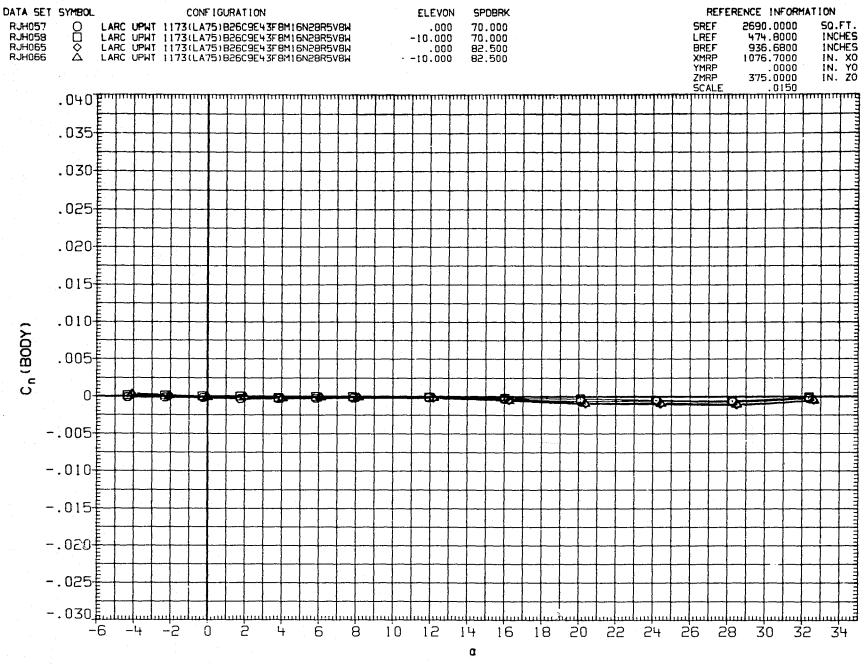
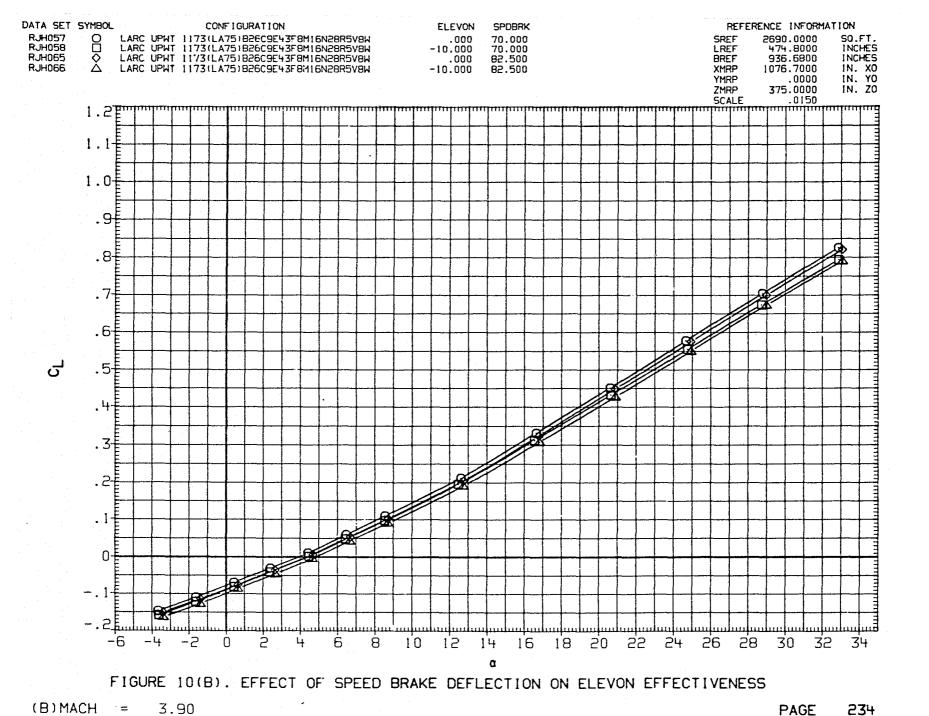
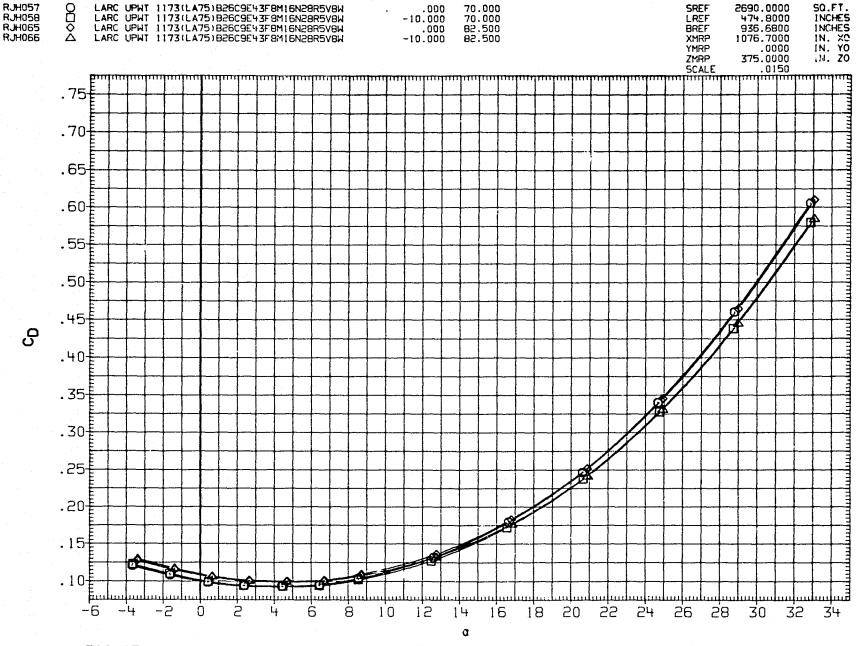


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS





ELEVON

SPDBRK

FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

(B)MACH = 3.90

DATA SET SYMBOL

**CONFIGURATION** 

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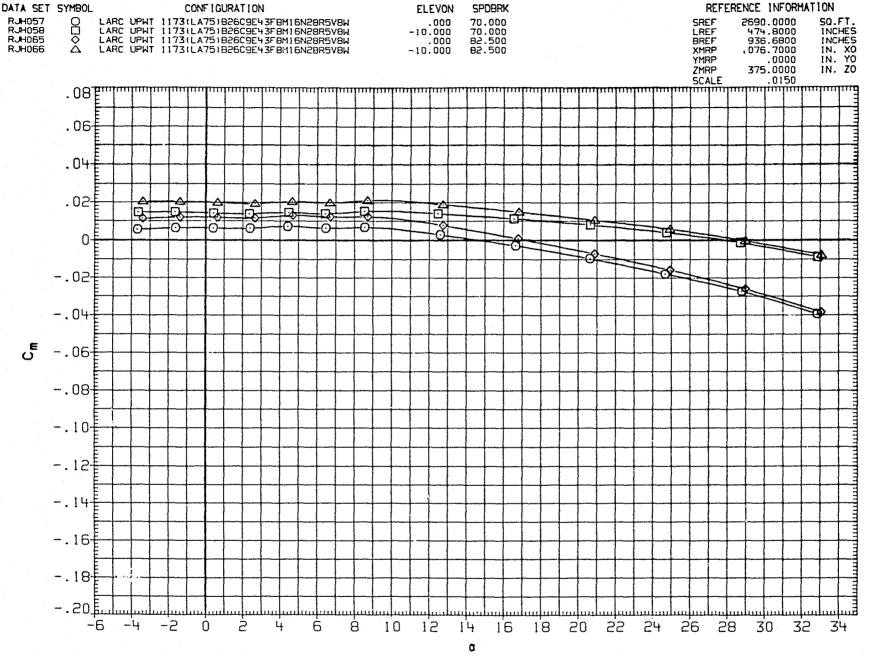


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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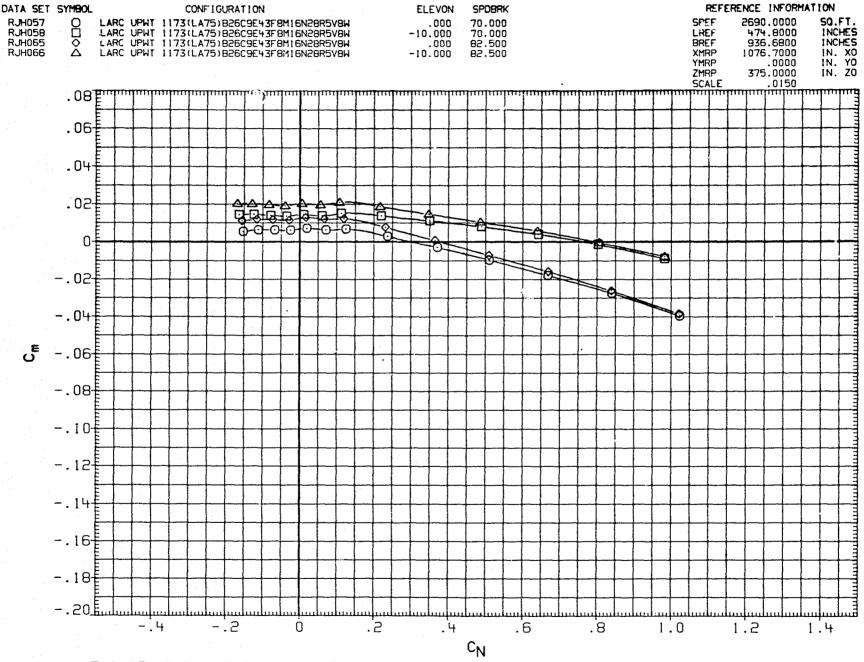


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

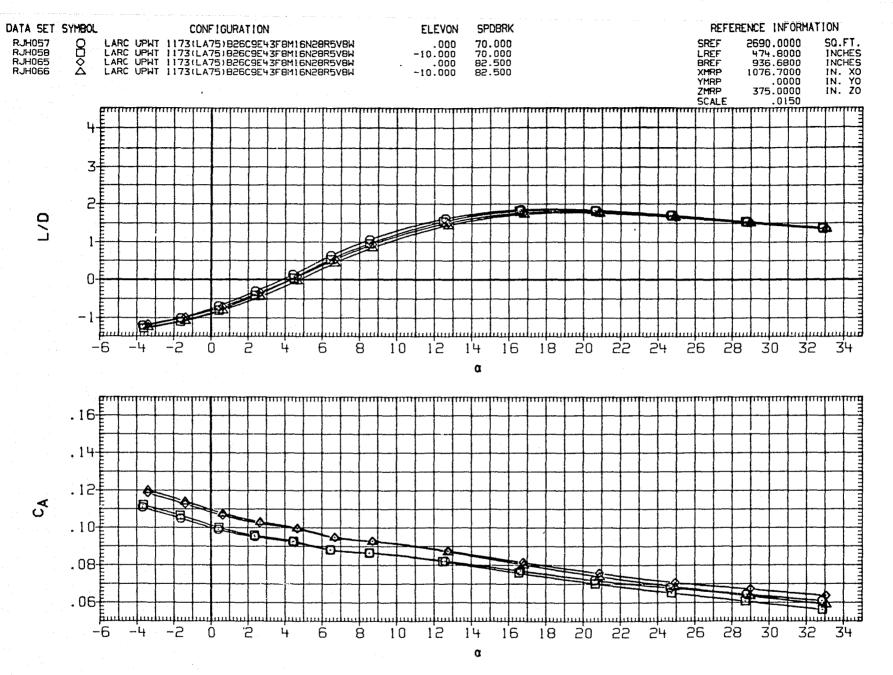


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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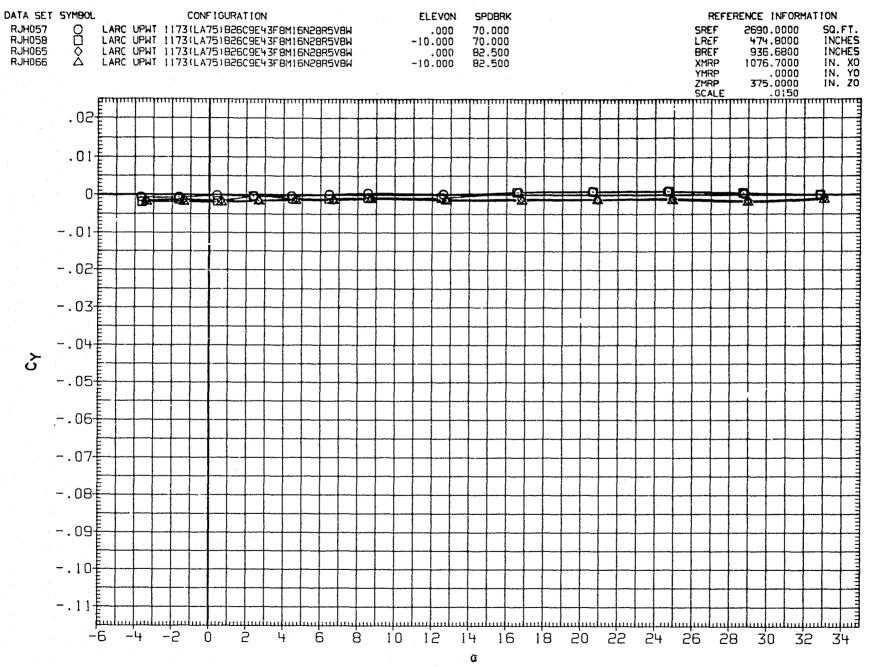


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

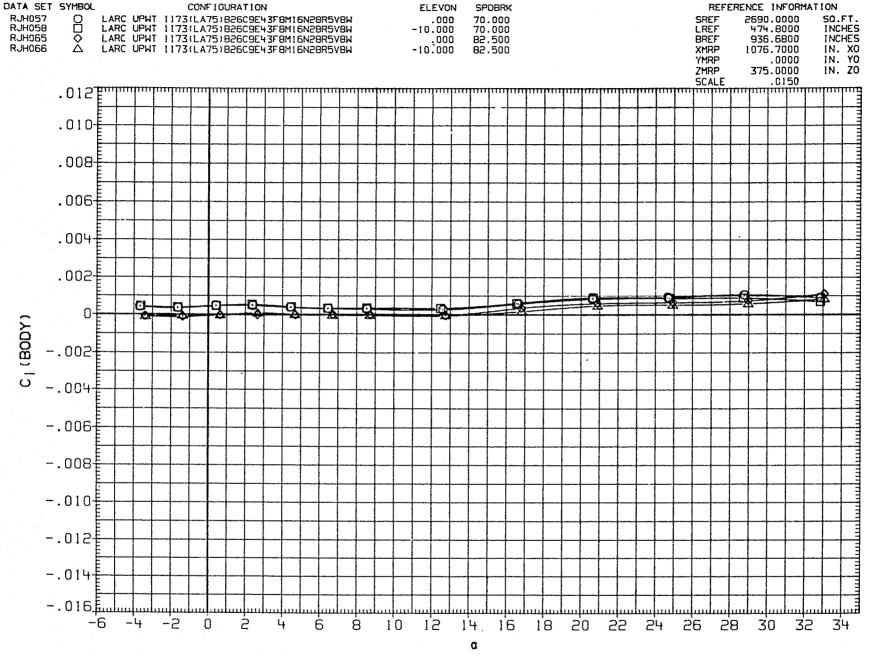


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

(B)MACH = 3.90

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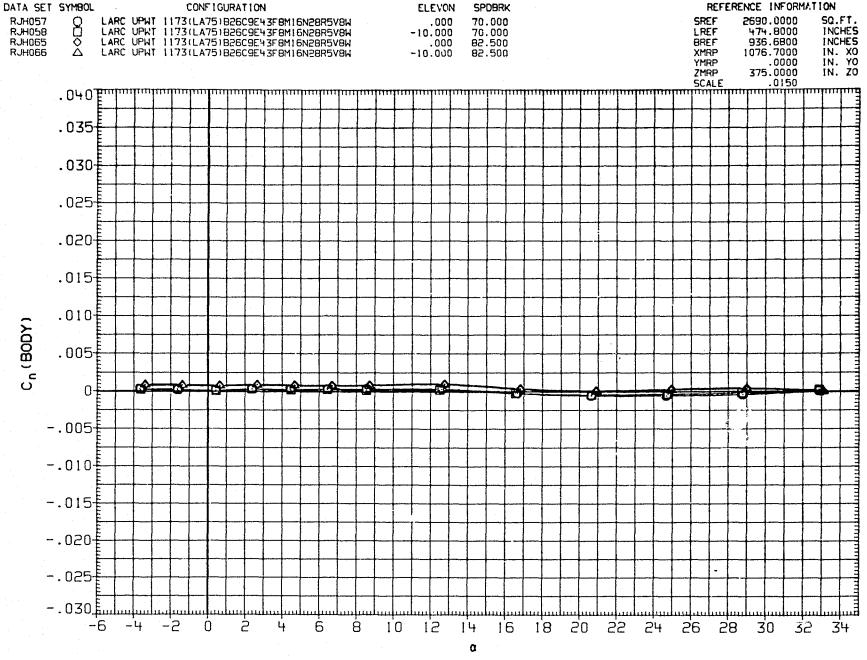
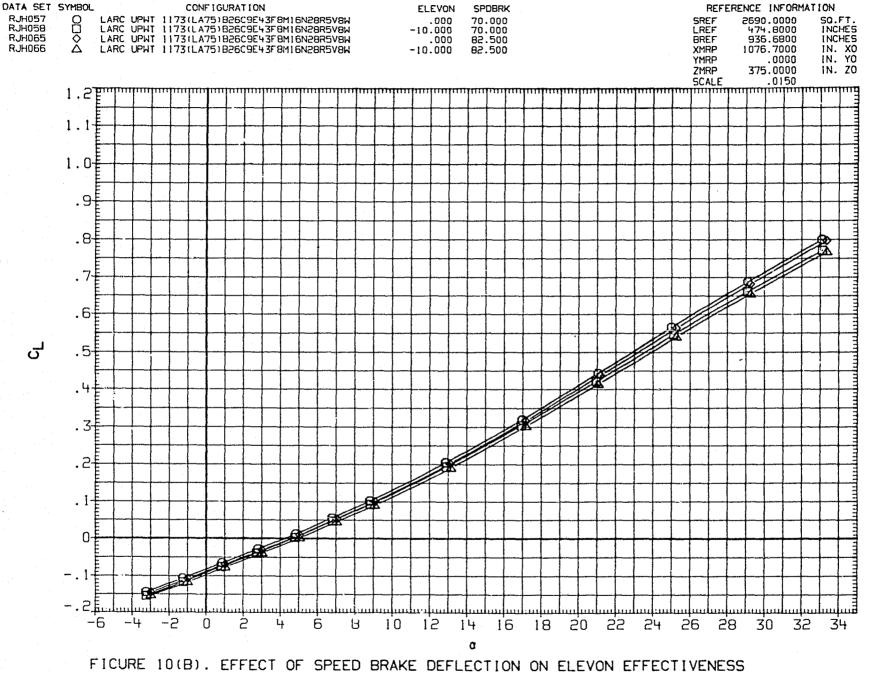


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

(B)MACH = 3.90



(C) MACH = 4.60 PAGE 242

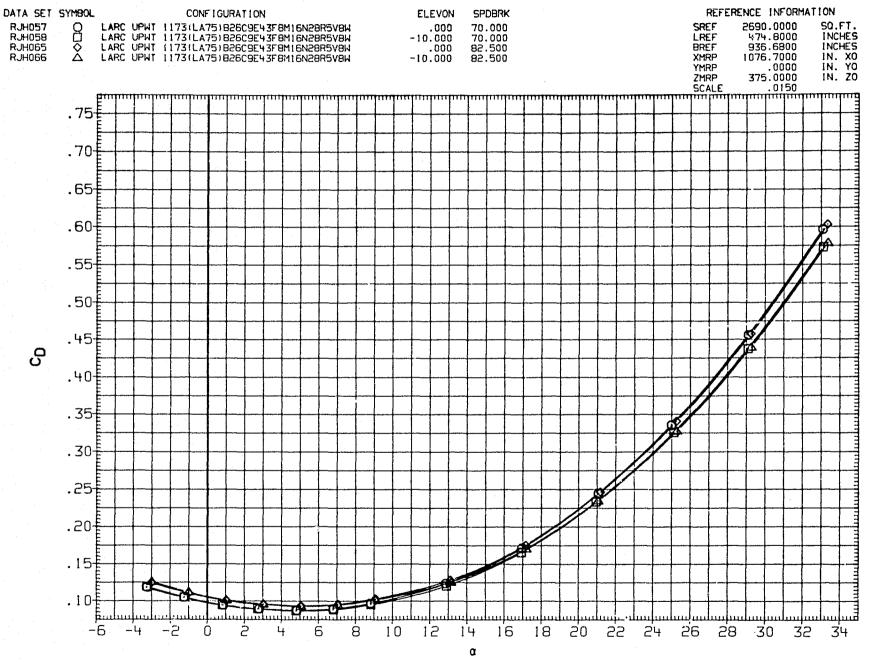
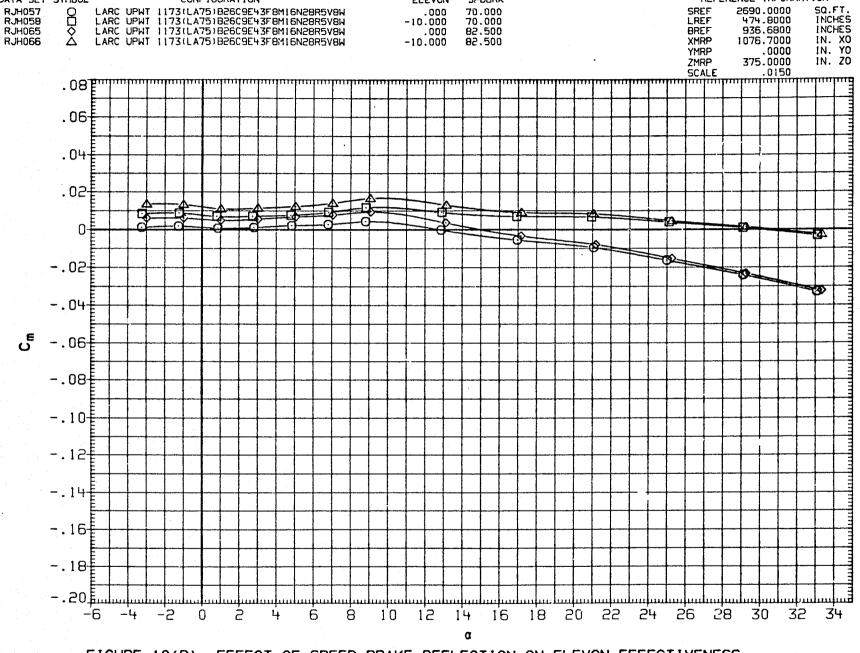


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS



DATA SET SYMBOL



ELEVON

SPDBRK

FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

(C)MACH = 4.60

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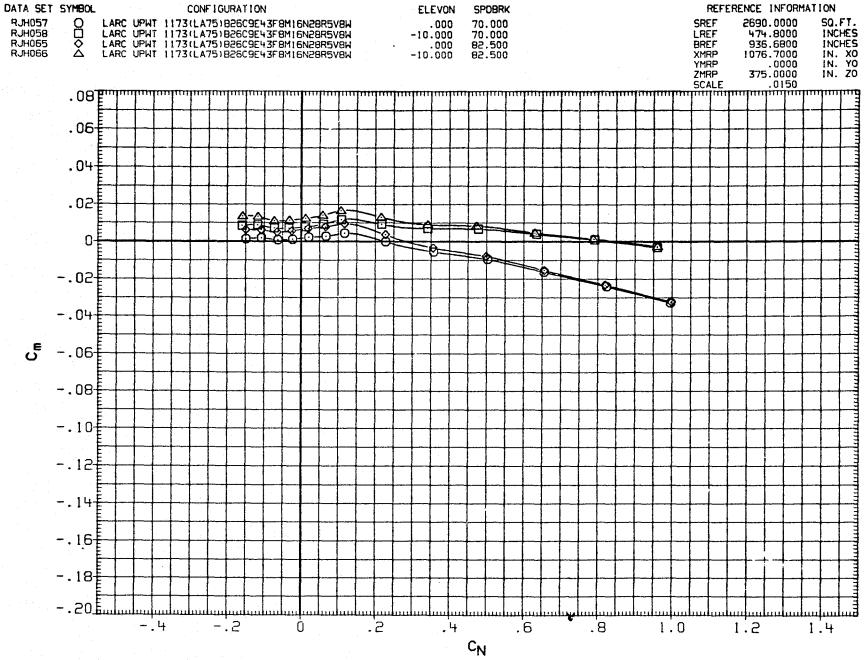


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

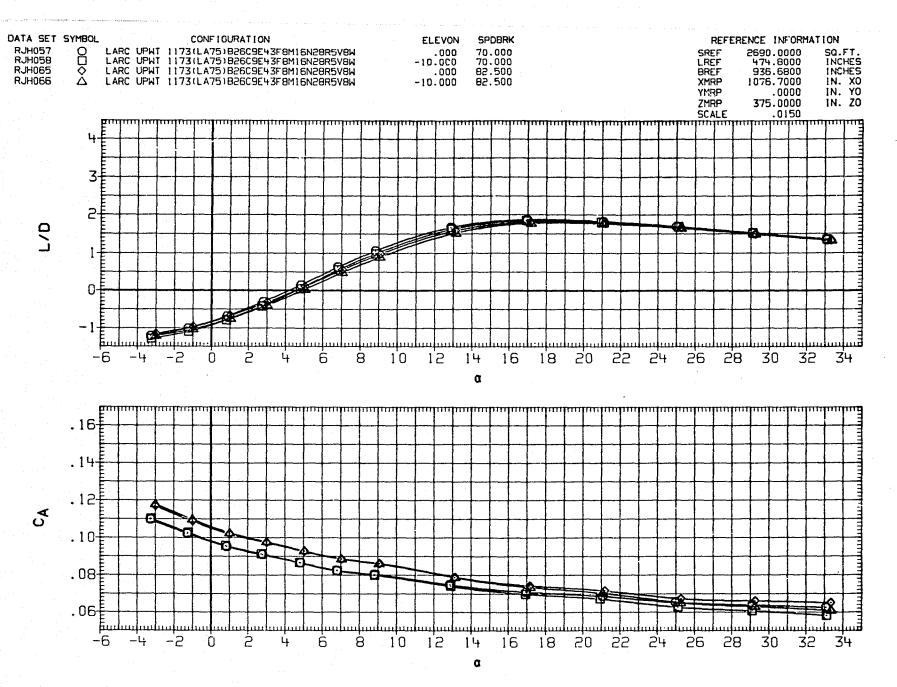


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

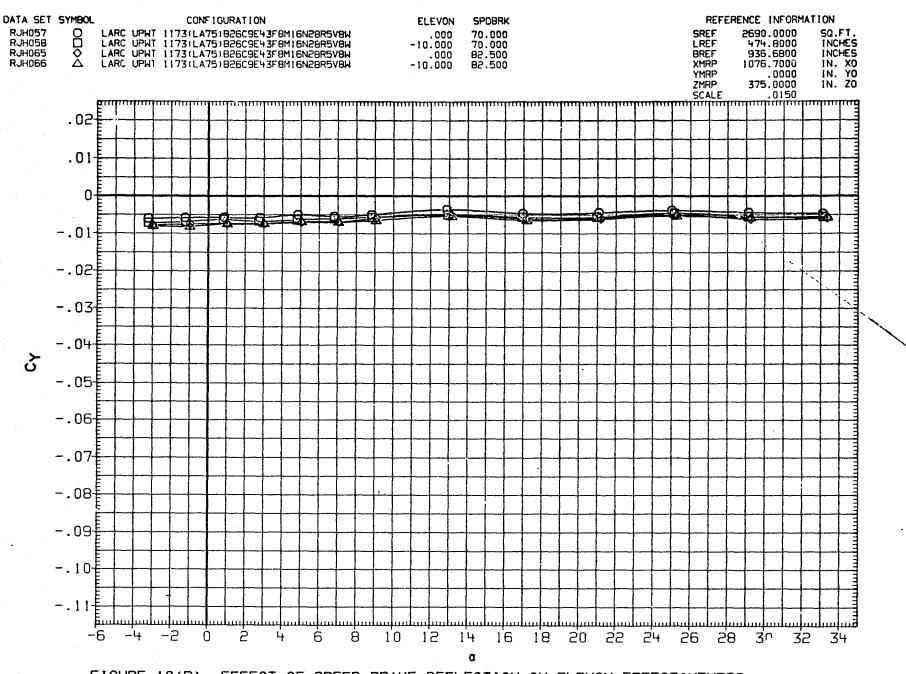


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS (C)MACH = 4.60

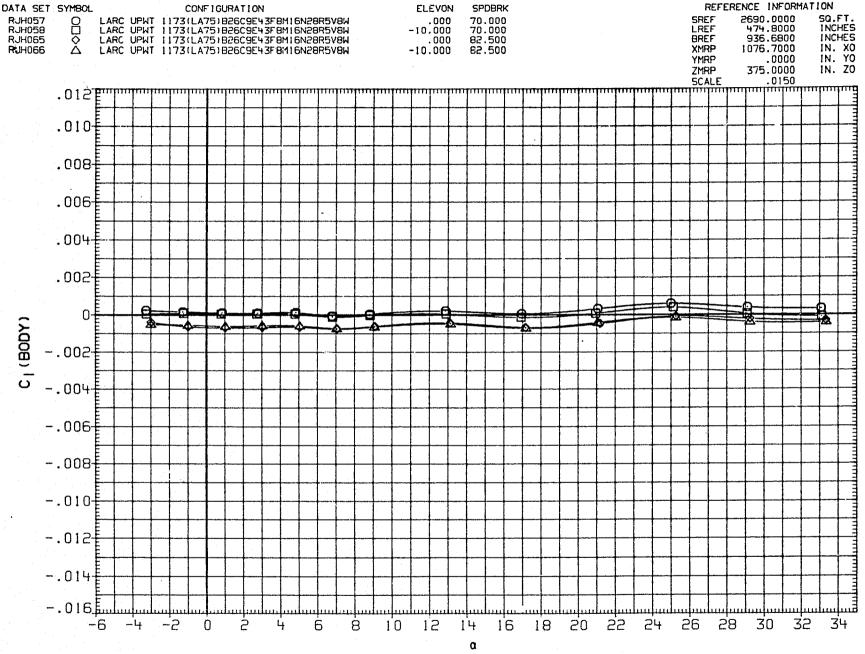


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

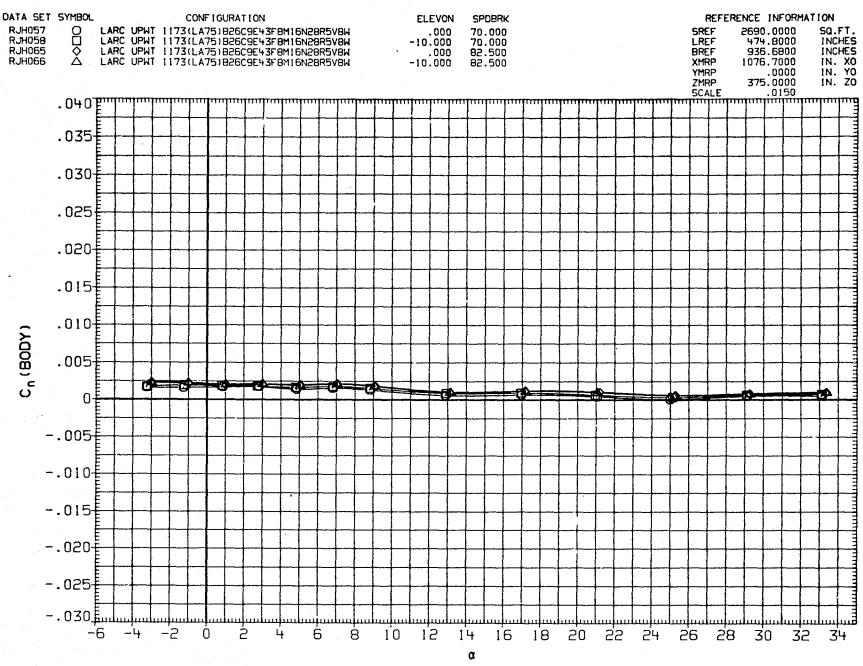


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

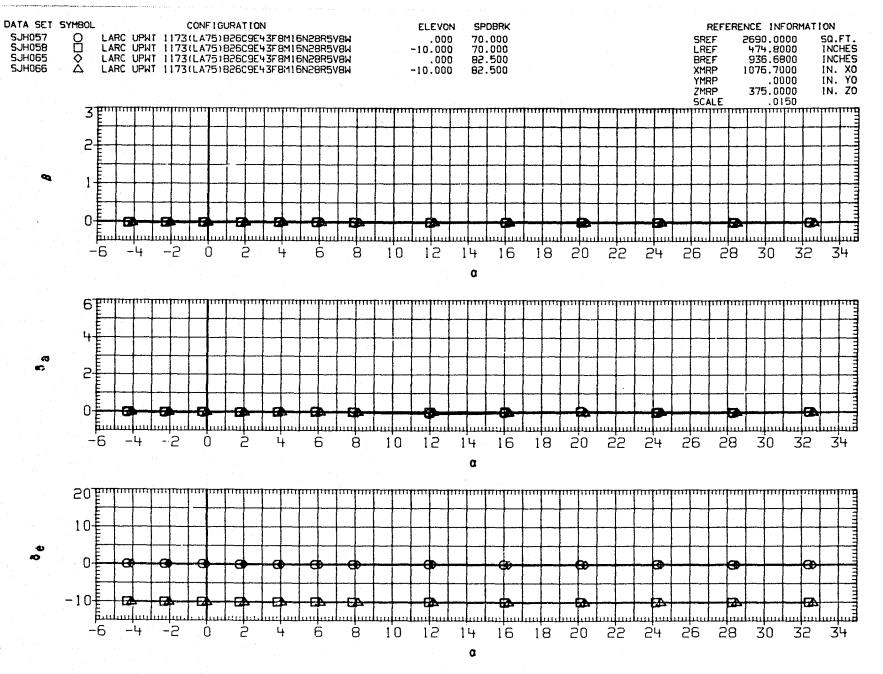


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

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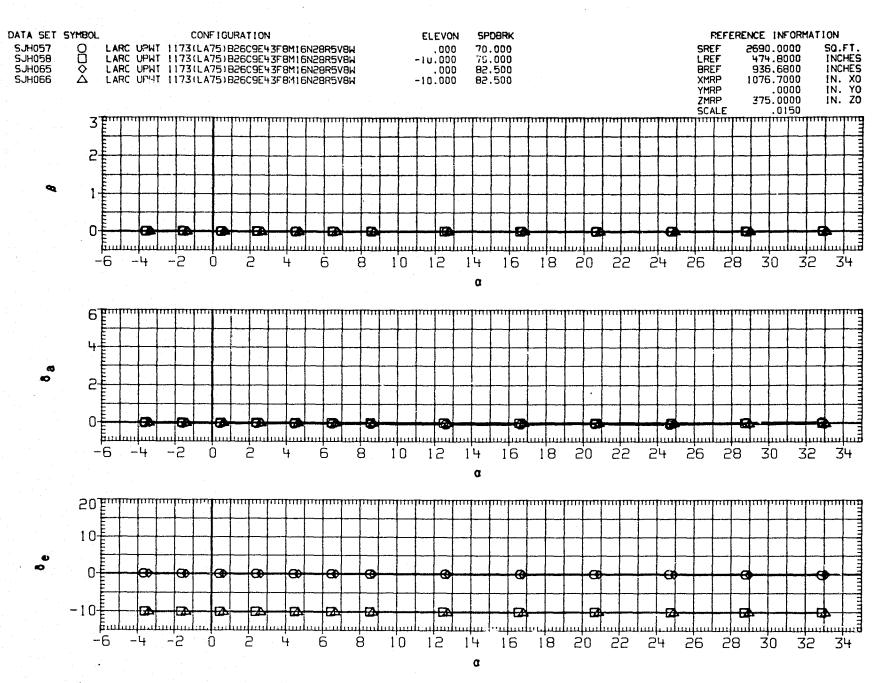


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

(B)MACH = 3.90

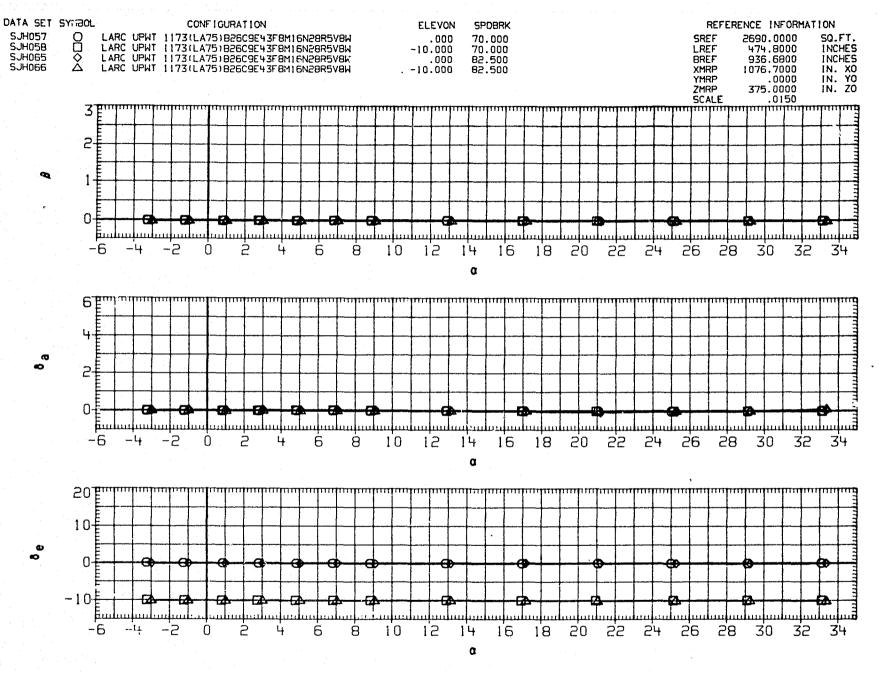


FIGURE 10(B). EFFECT OF SPEED BRAKE DEFLECTION ON ELEVON EFFECTIVENESS

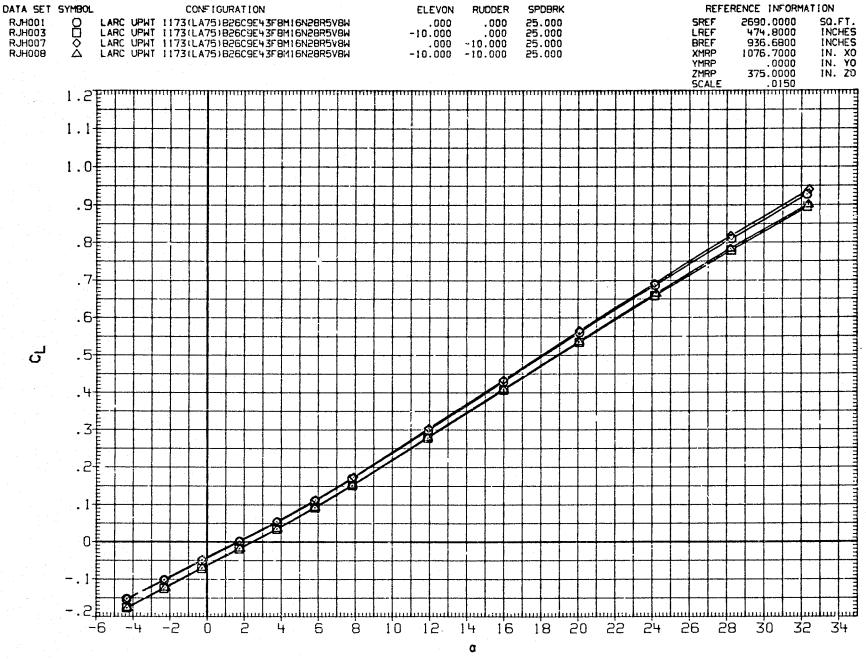


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

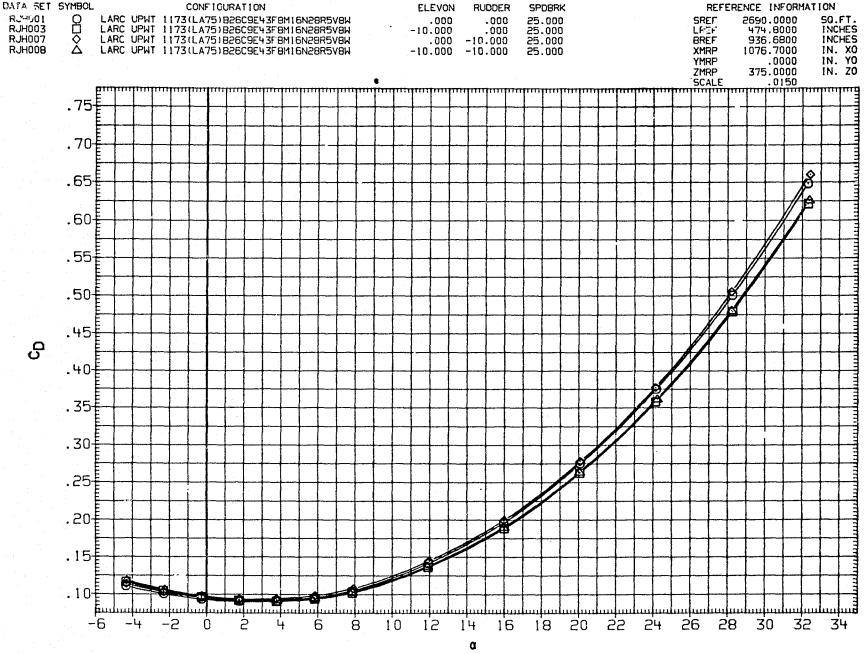


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

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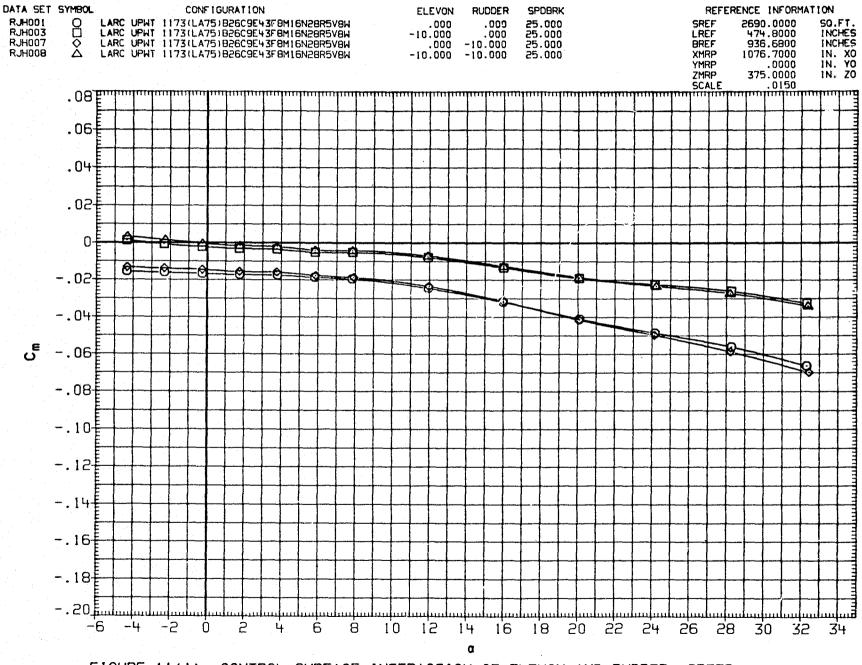


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

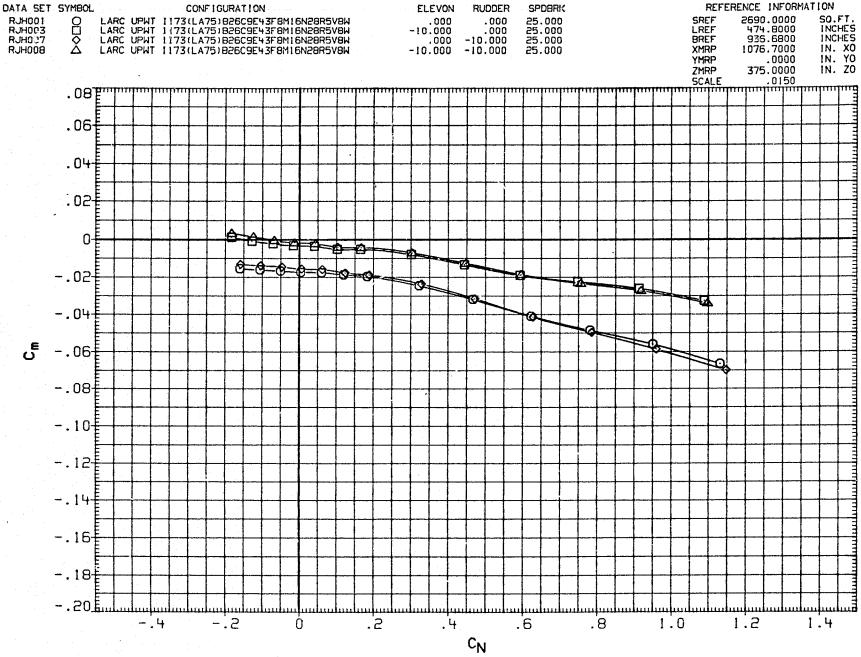


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

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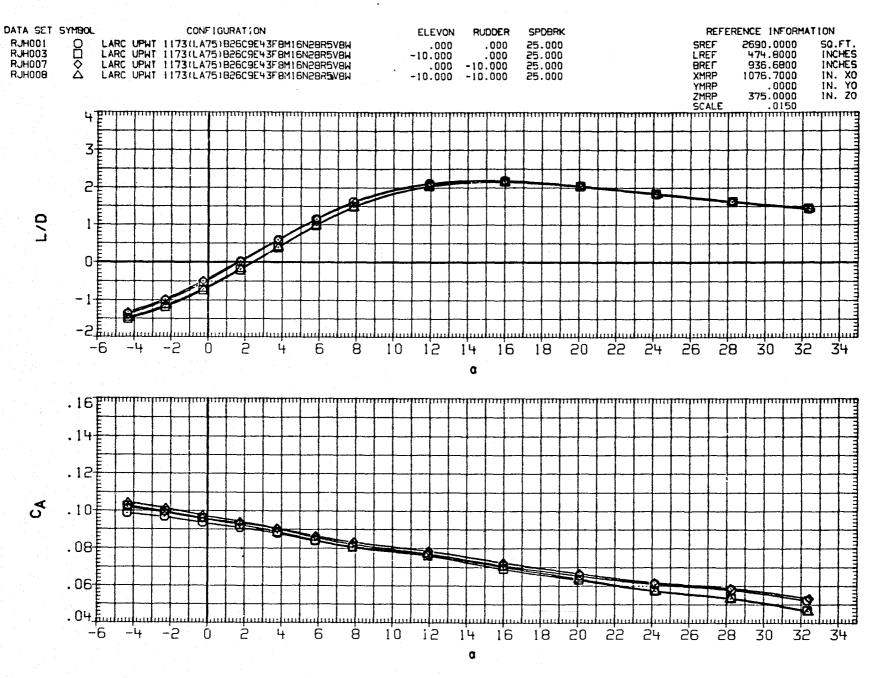


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

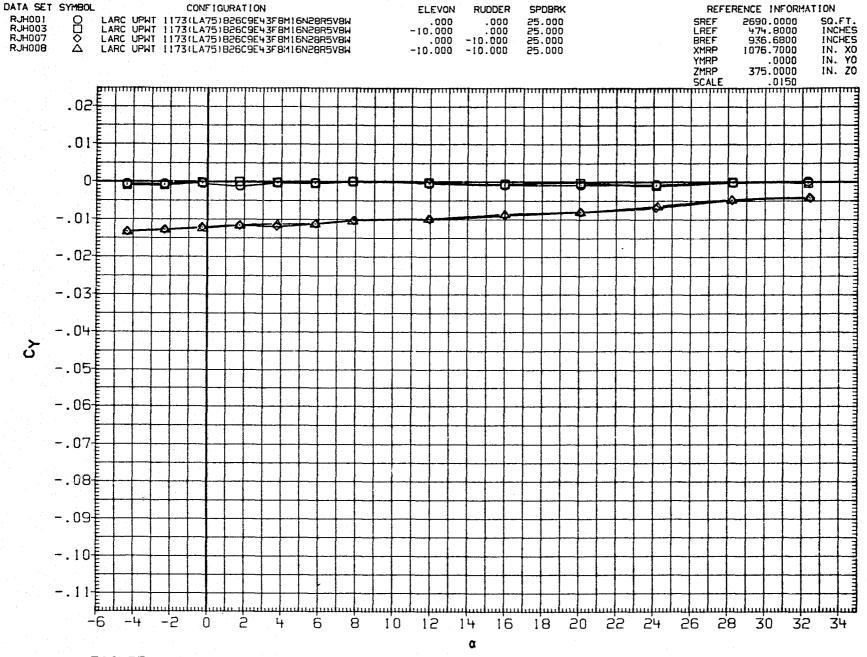
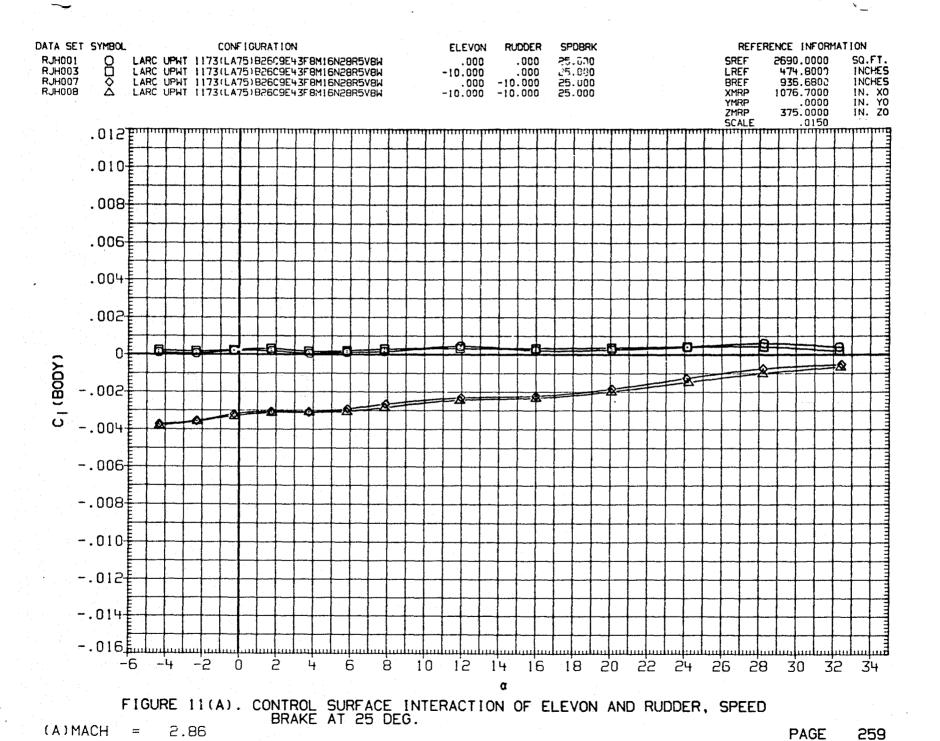


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED

BRAKE AT 25 DEG.

(A) MACH = 2.86

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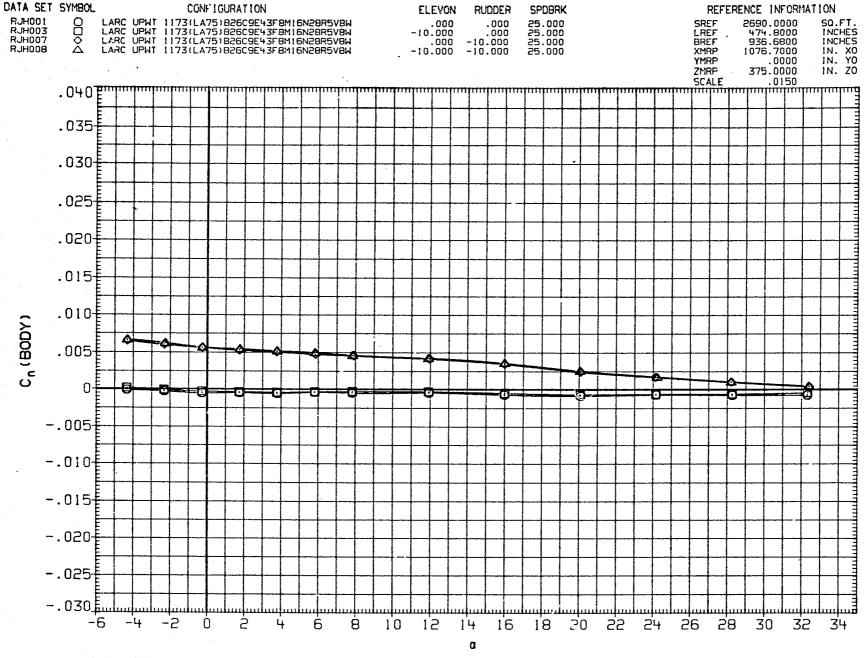


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 25 DEG.

(A) MACH = 2.86

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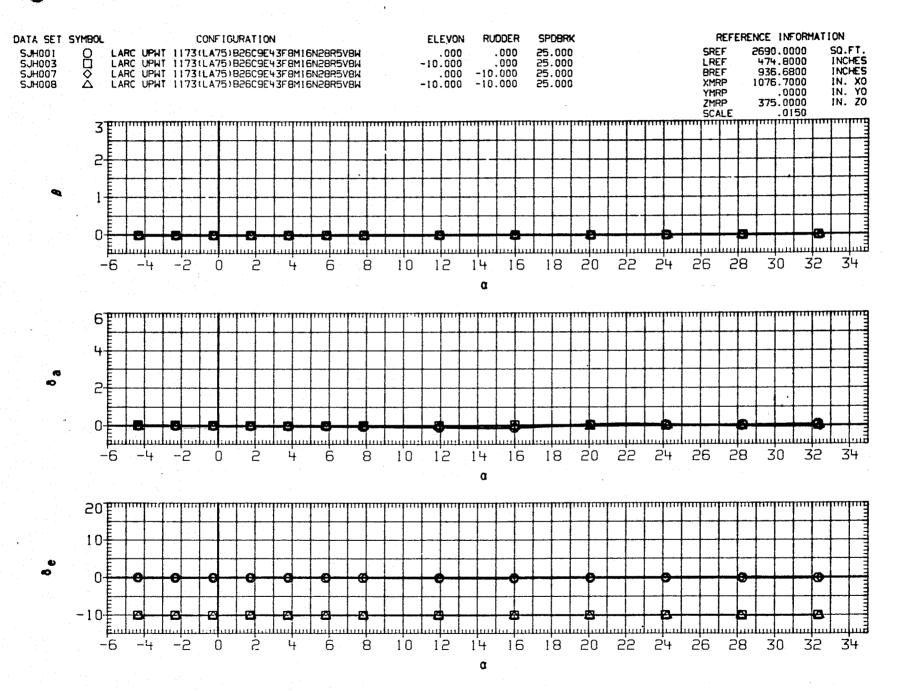


FIGURE 11(A). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

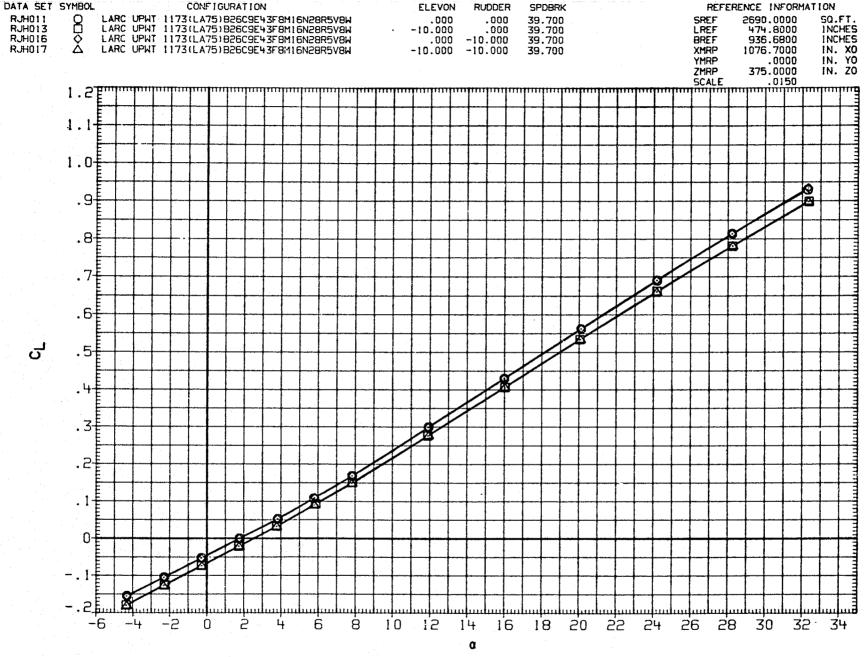


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(A) MACH = 2.86

PAGE

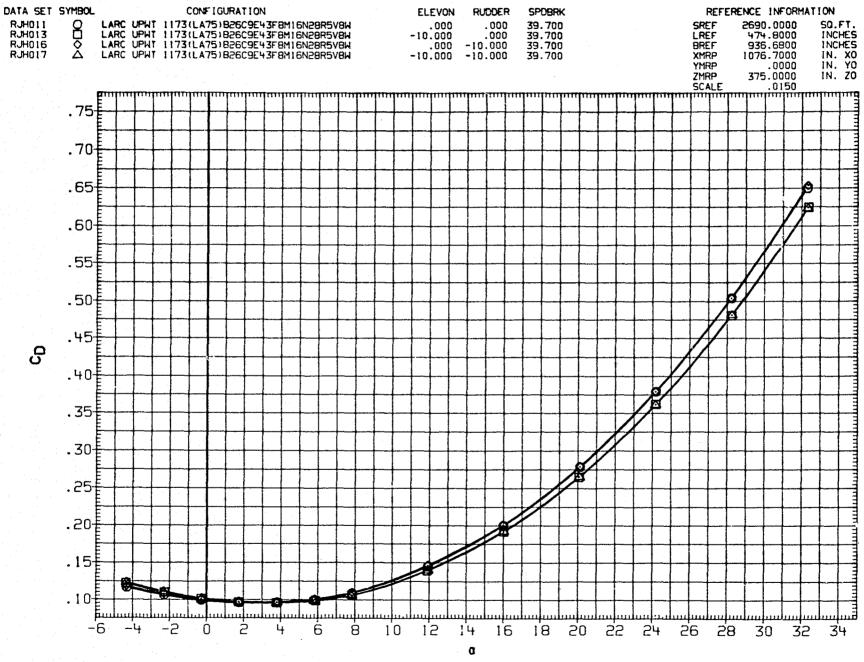


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

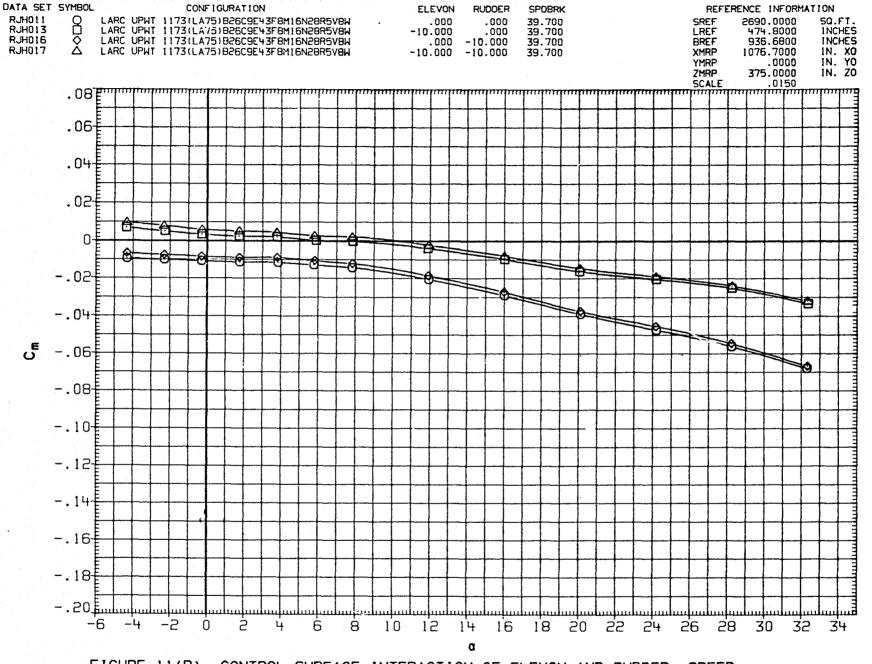


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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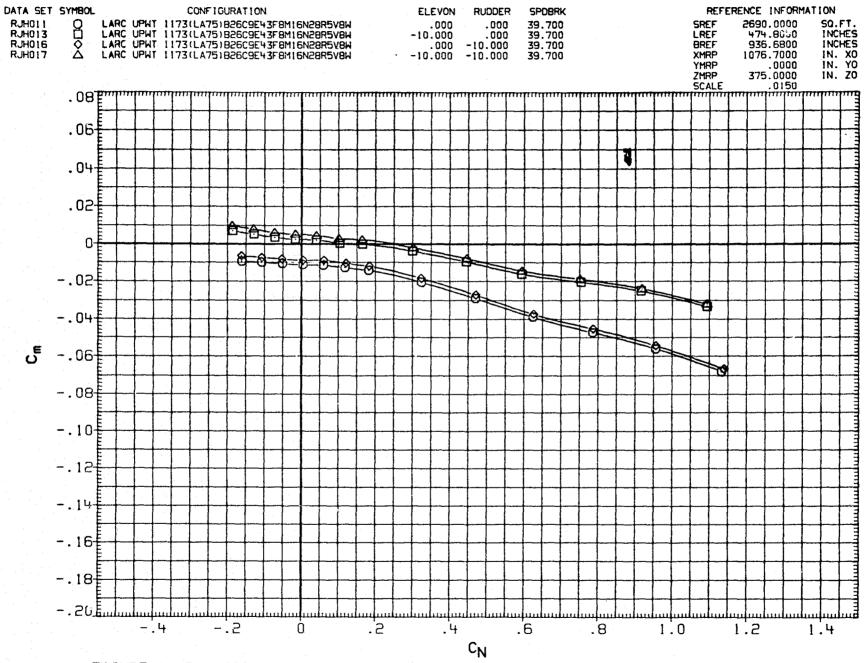


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG. 2.86

(A) MACH

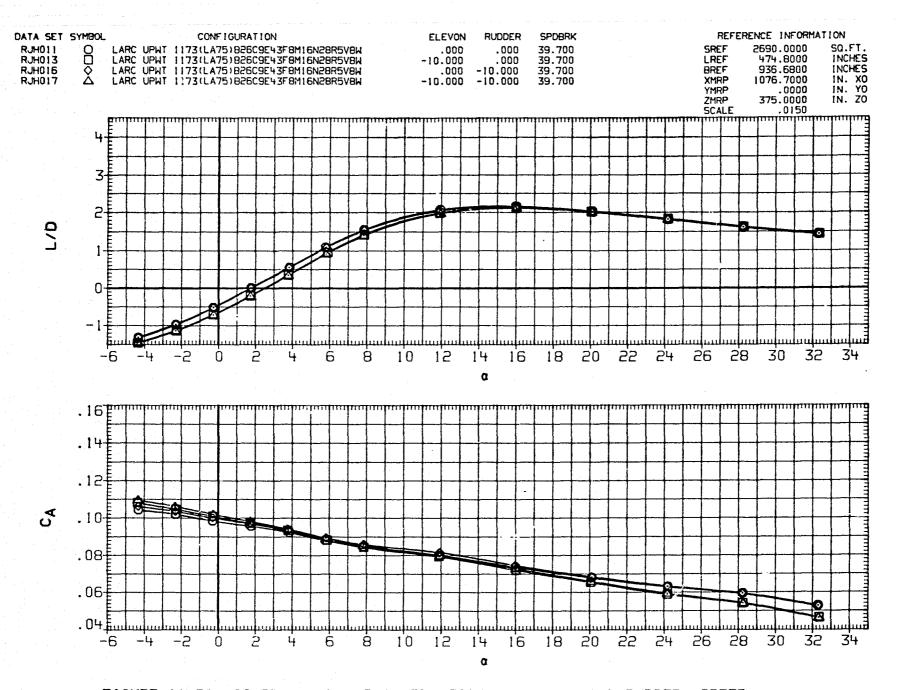


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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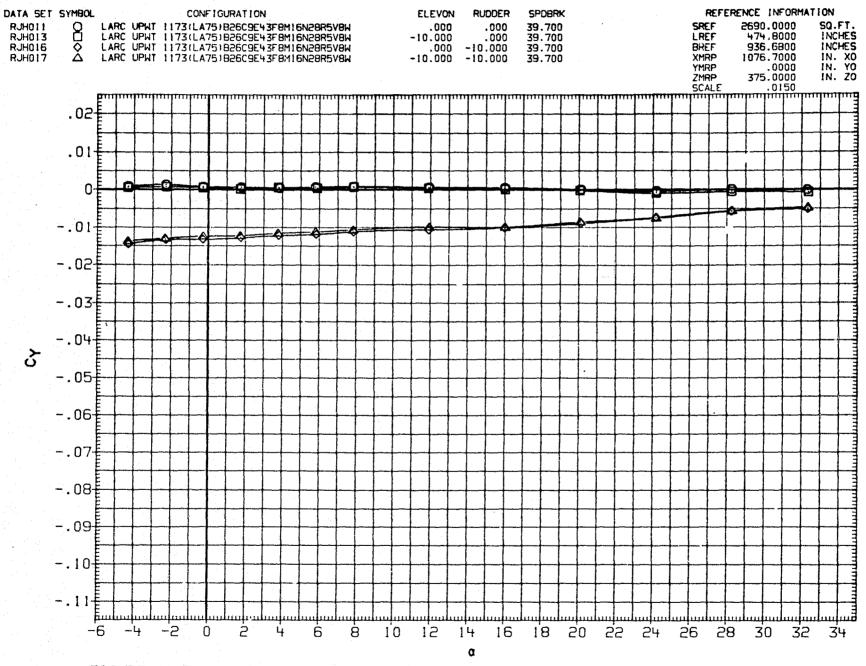


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

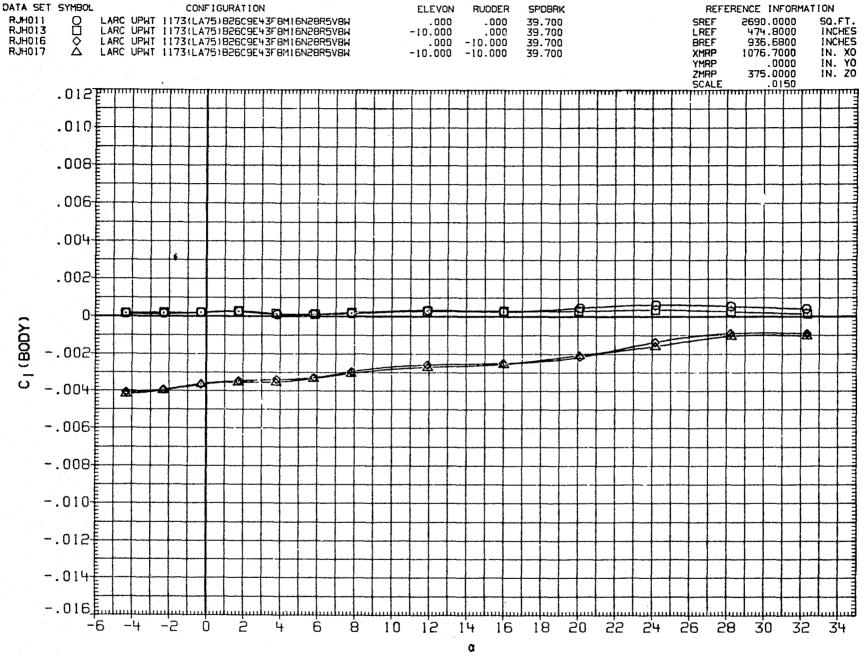


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

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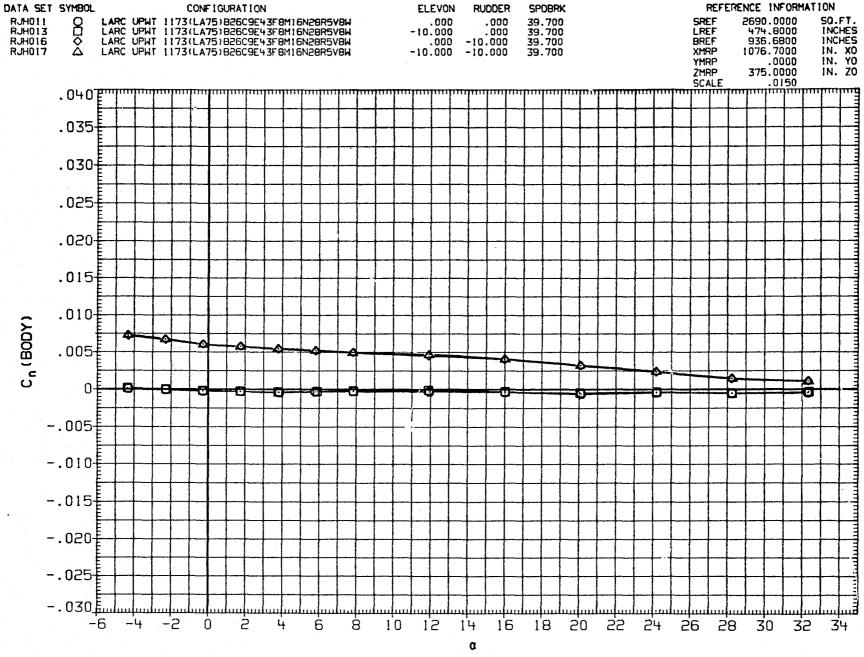


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

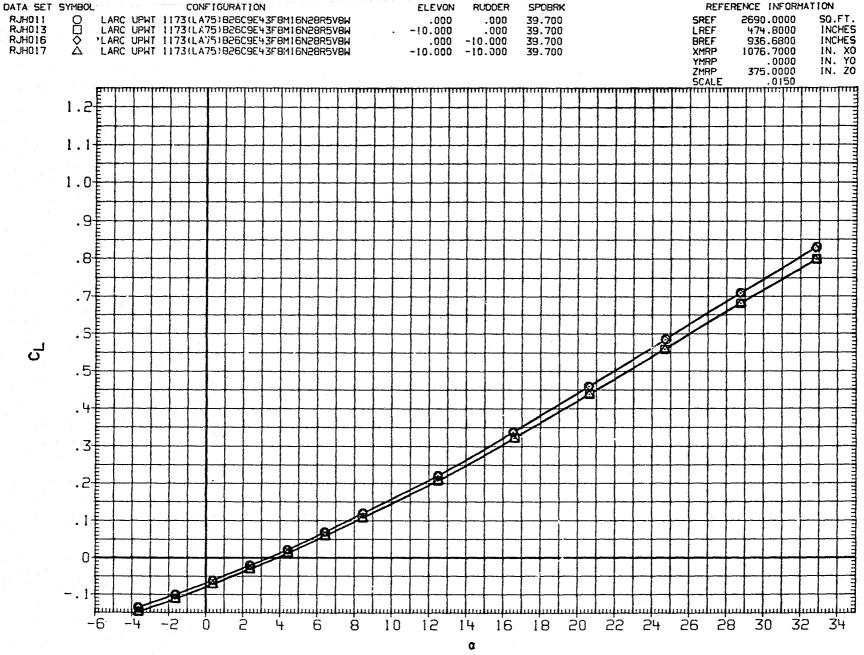


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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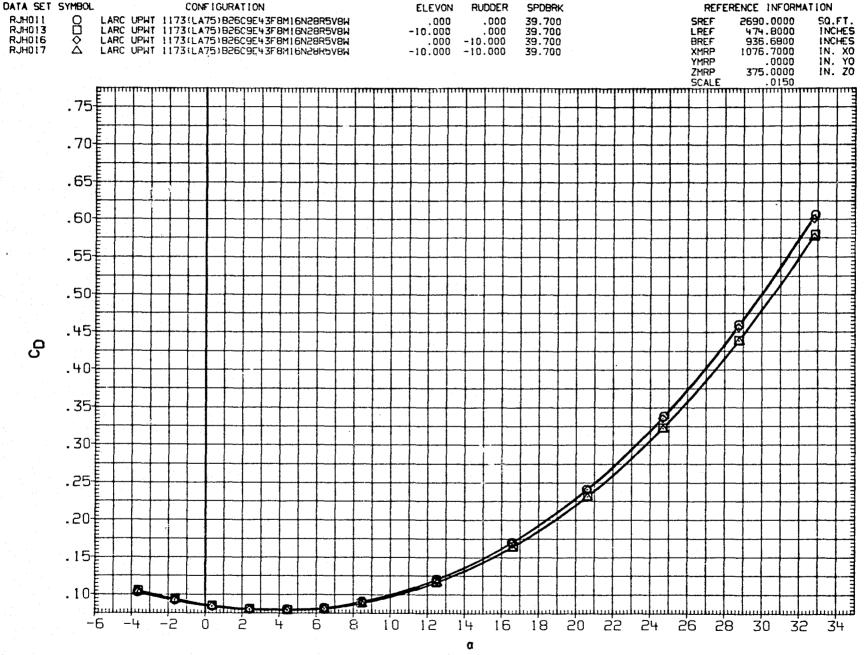
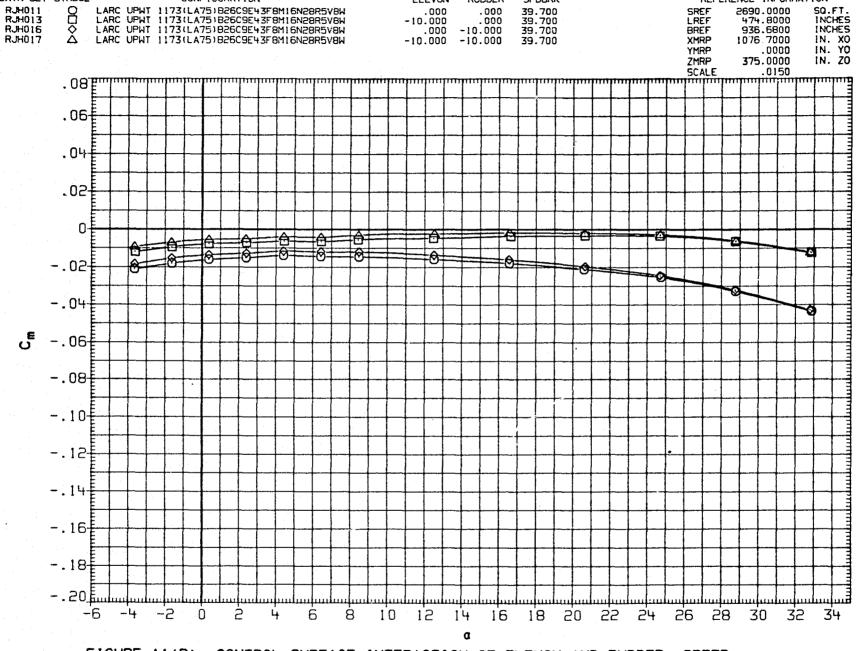


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90



ELEVON

RUDDER

SPDBRK

DATA SET SYMBOL

(B) MACH

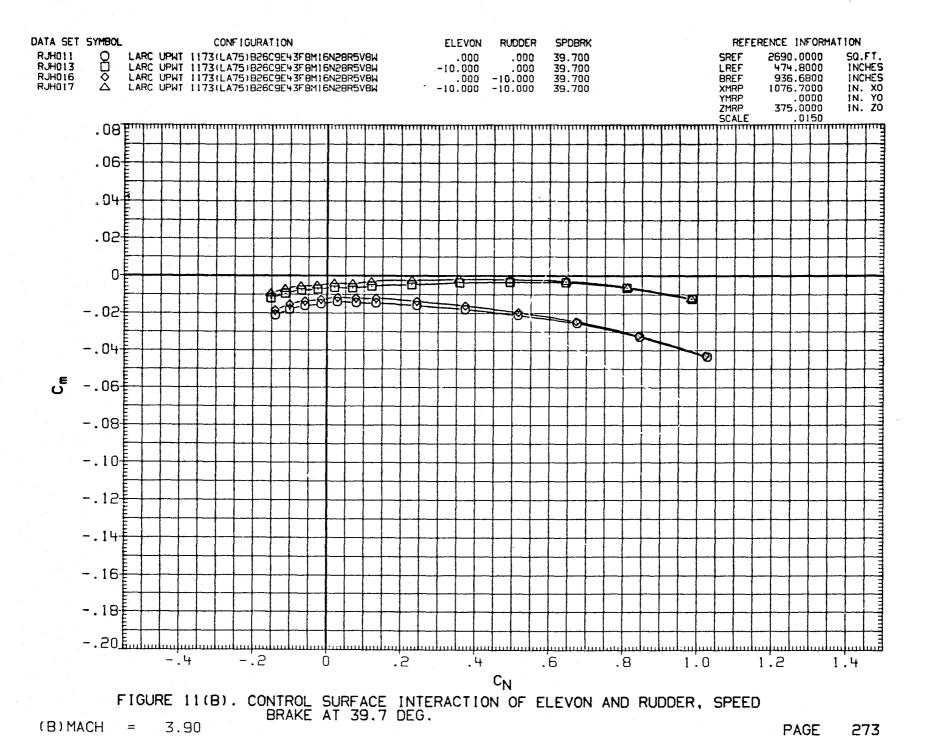
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FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.
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REFERENCE INFORMATION



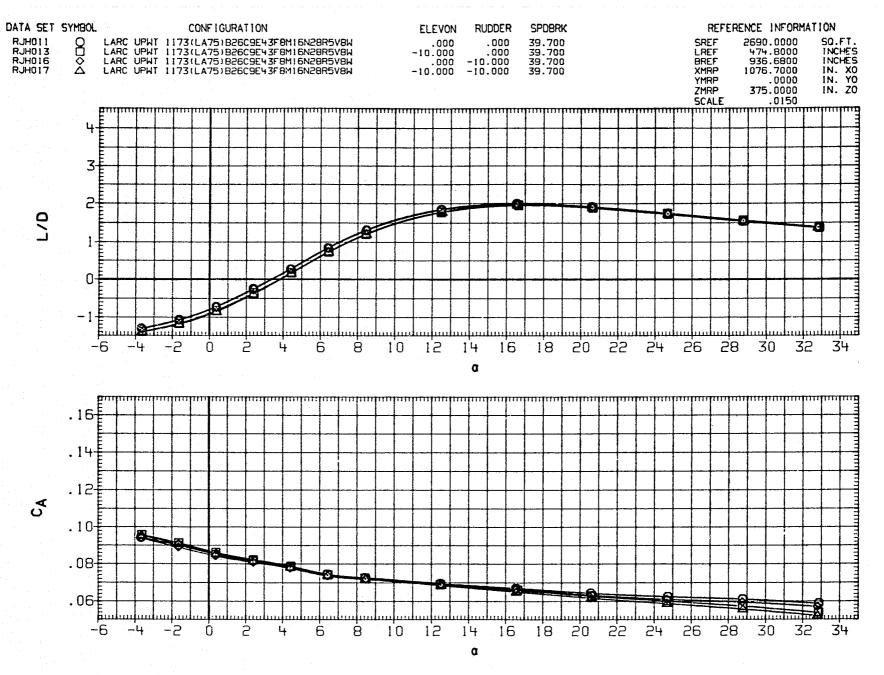


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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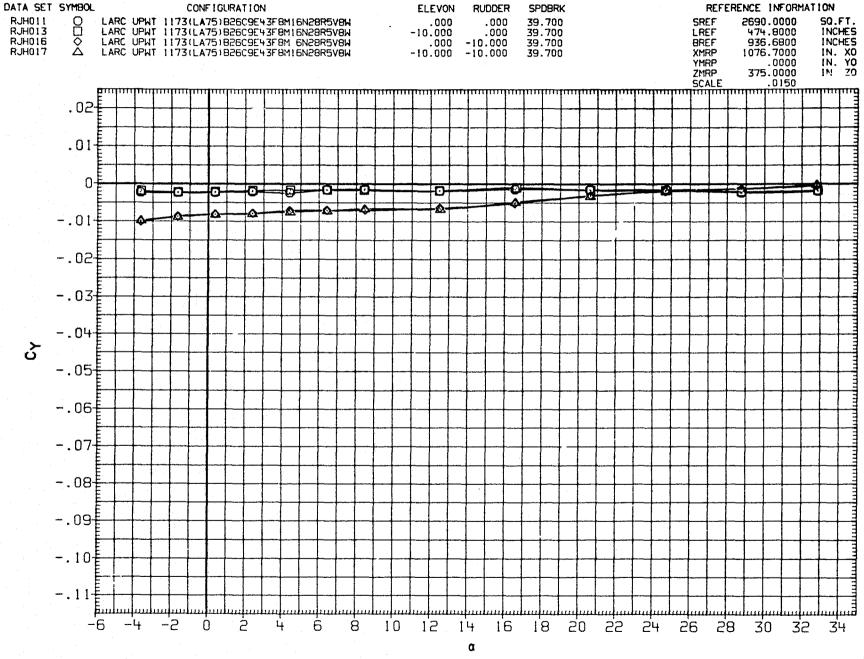


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(B)MACH = 3.90

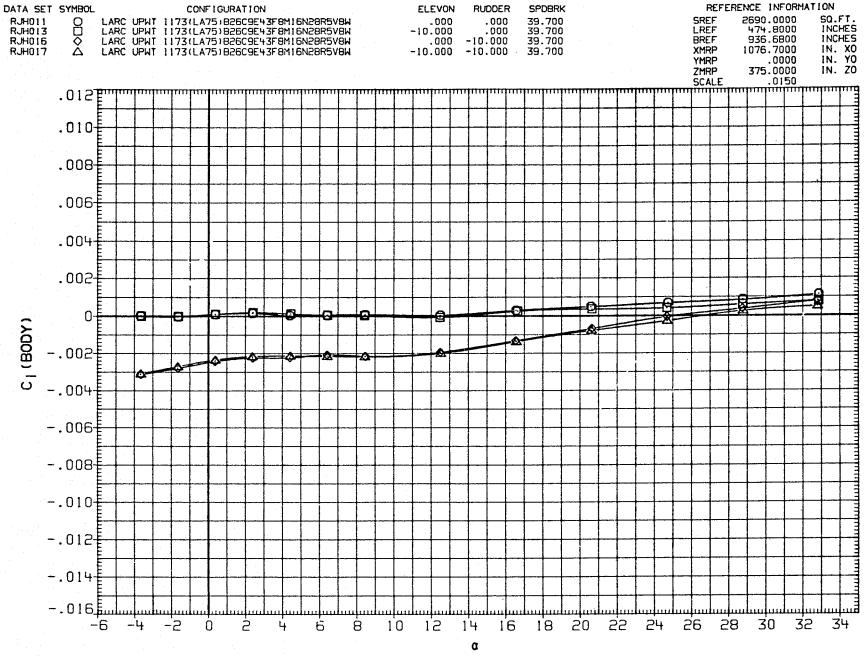


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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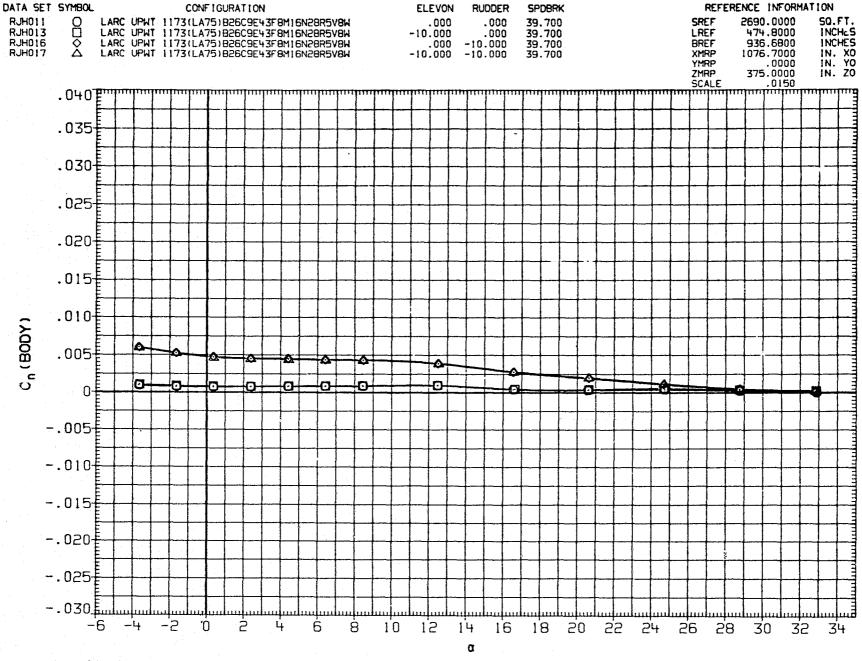


FIGURE 11(B). CONTROL SUPFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 33.7 DEG.

(B)MACH = 3.90

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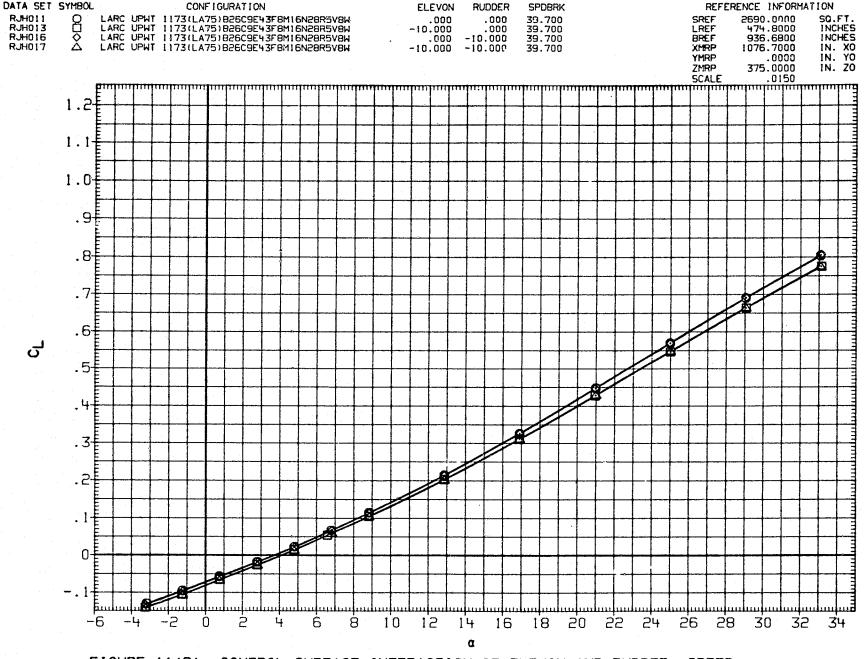


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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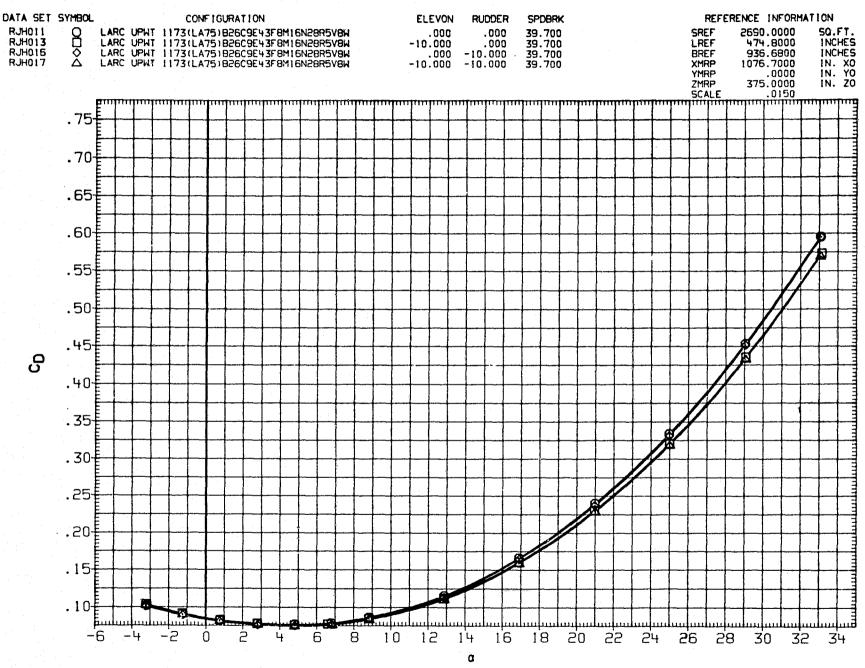


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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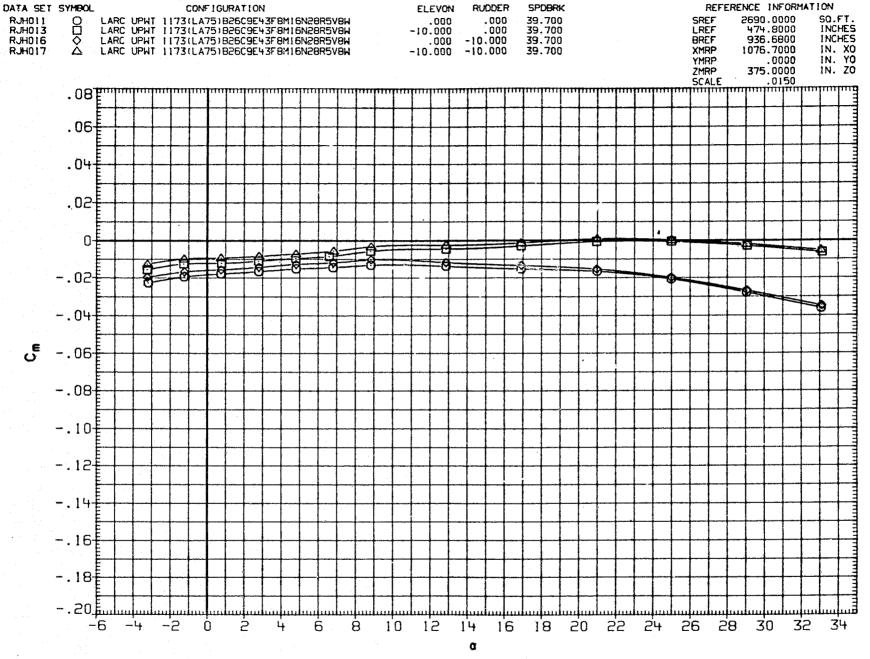


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(C) MACH = 4.60

PAGE

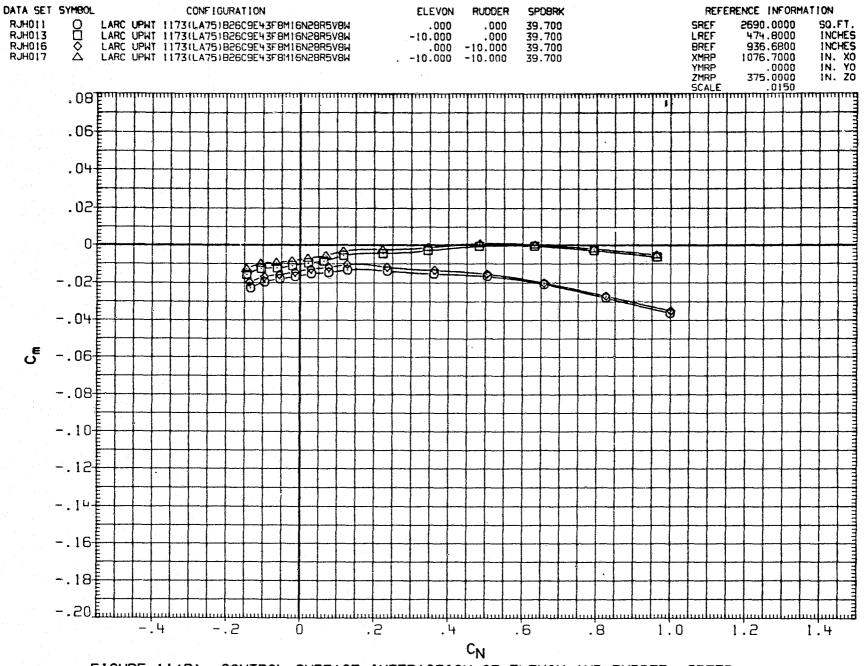


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

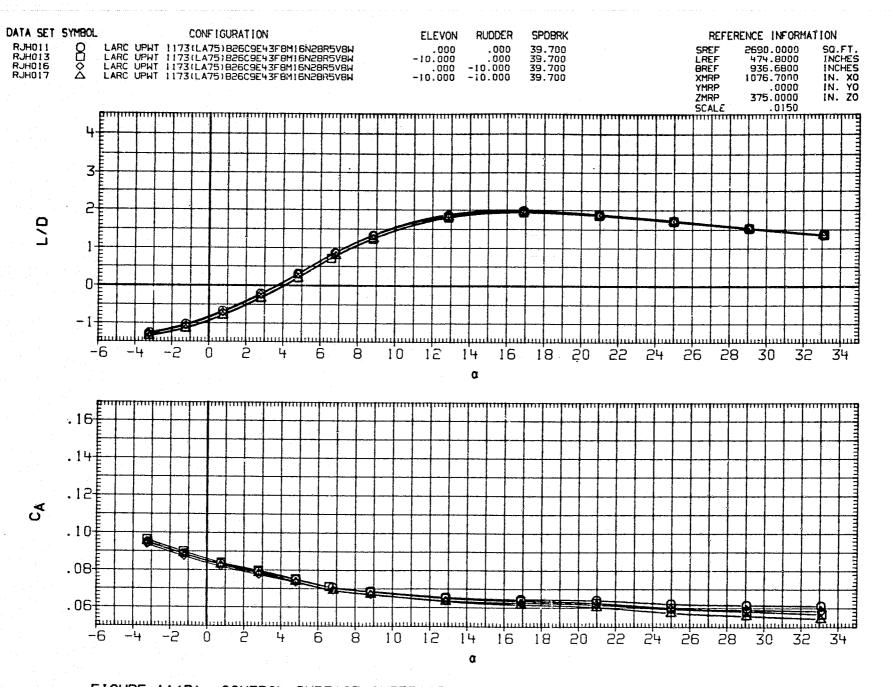


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 39.7 DEG.

(C) MACH = 4.60

PAGE

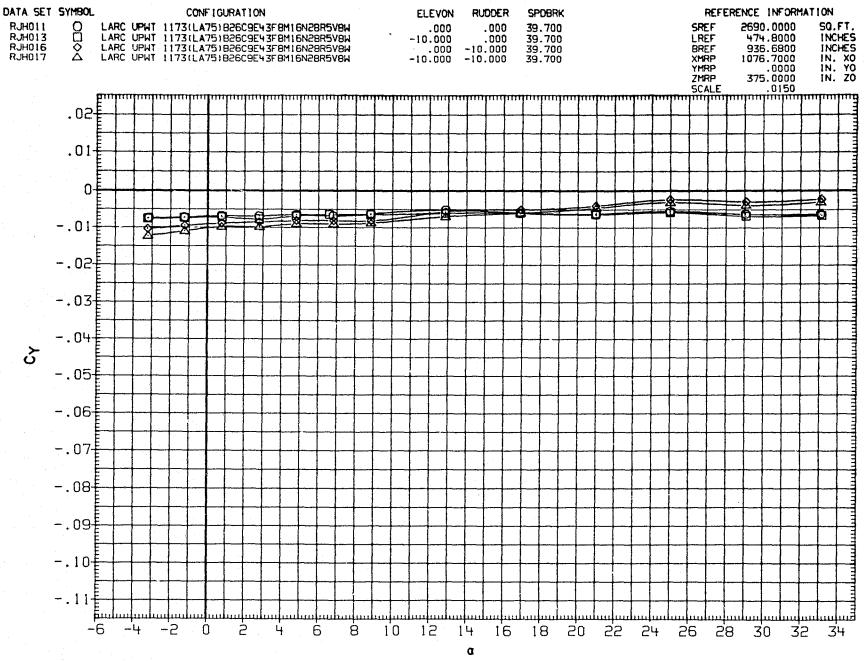


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

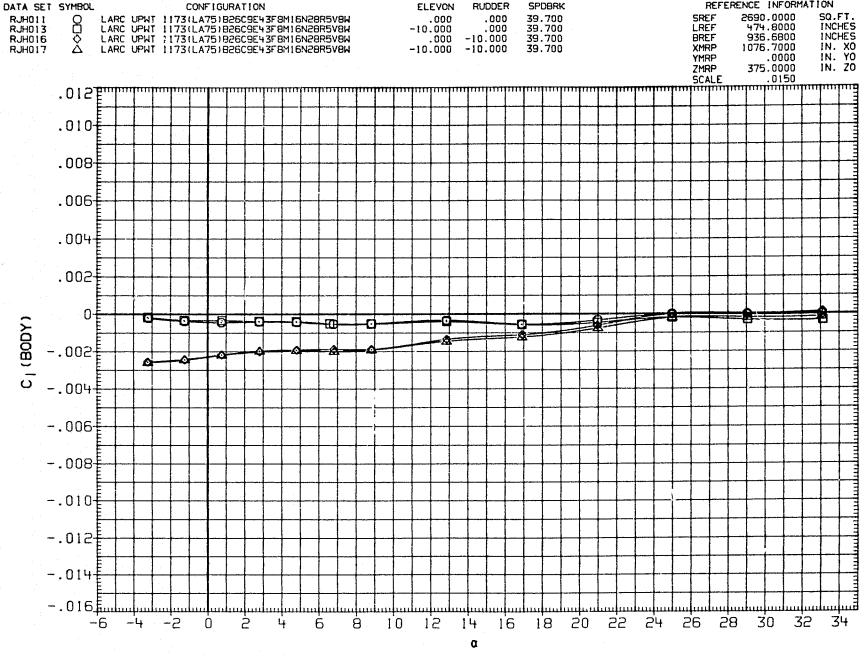


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG. (C)MACH = 4.60

REFERENCE INFORMATION

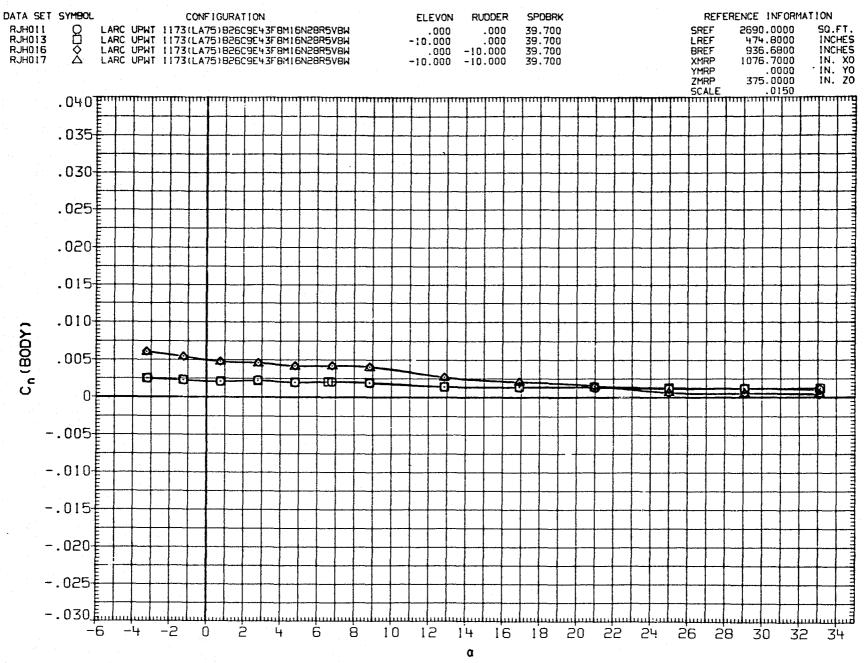


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

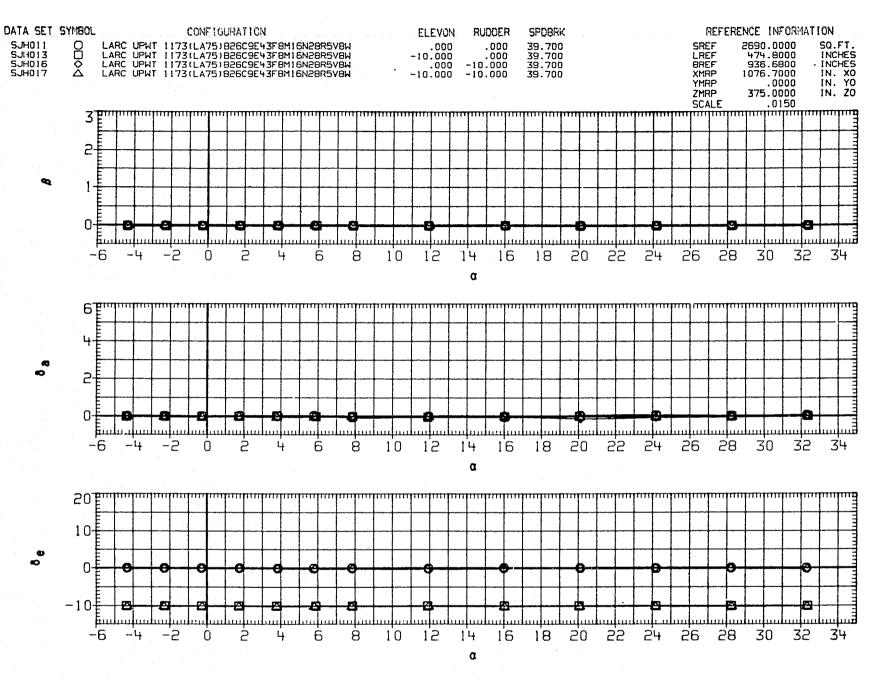


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(A)MACH = 2.86

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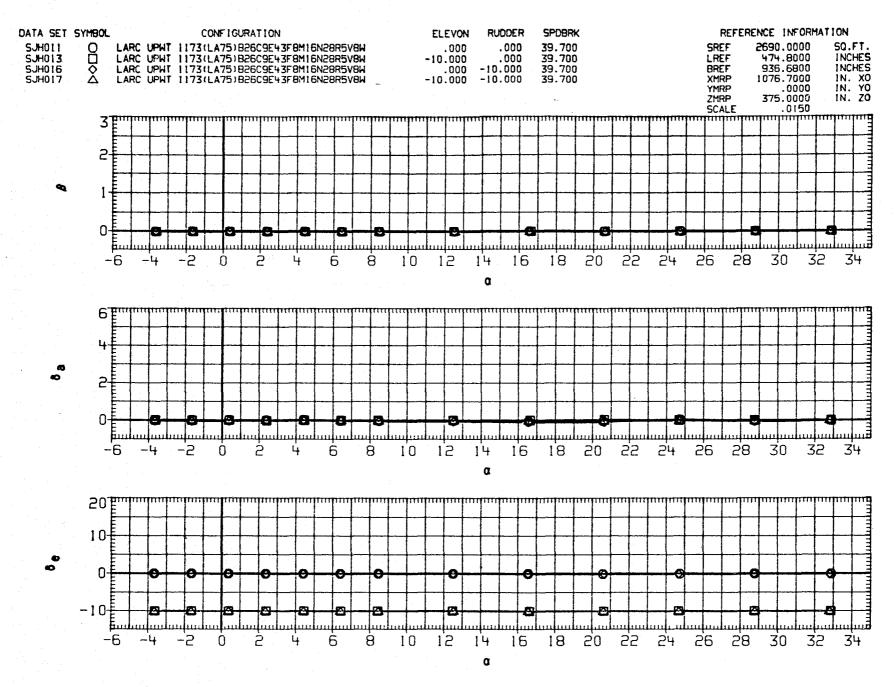


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

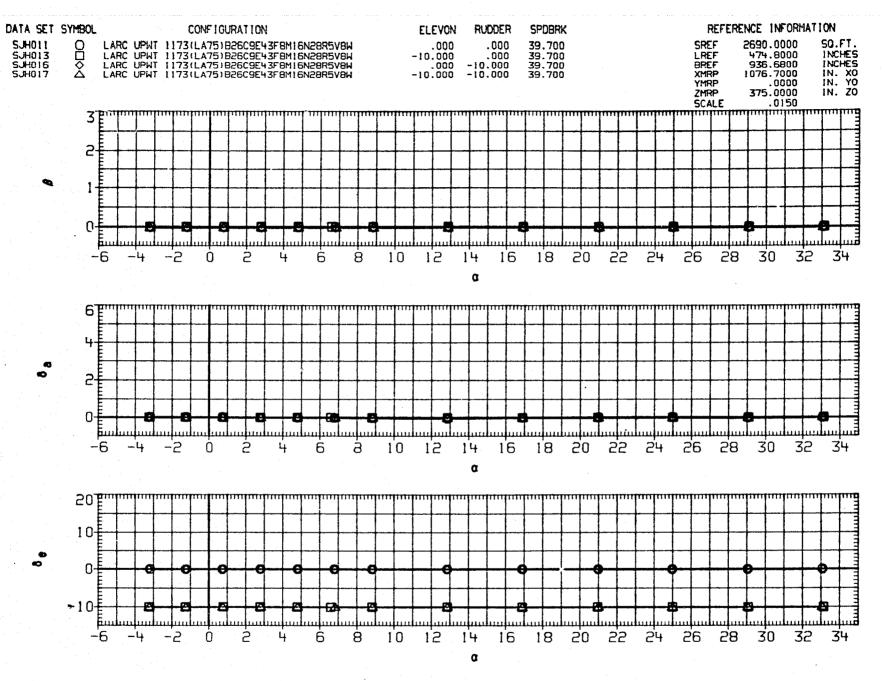


FIGURE 11(B). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 39.7 DEG. (C) MACH 4.60

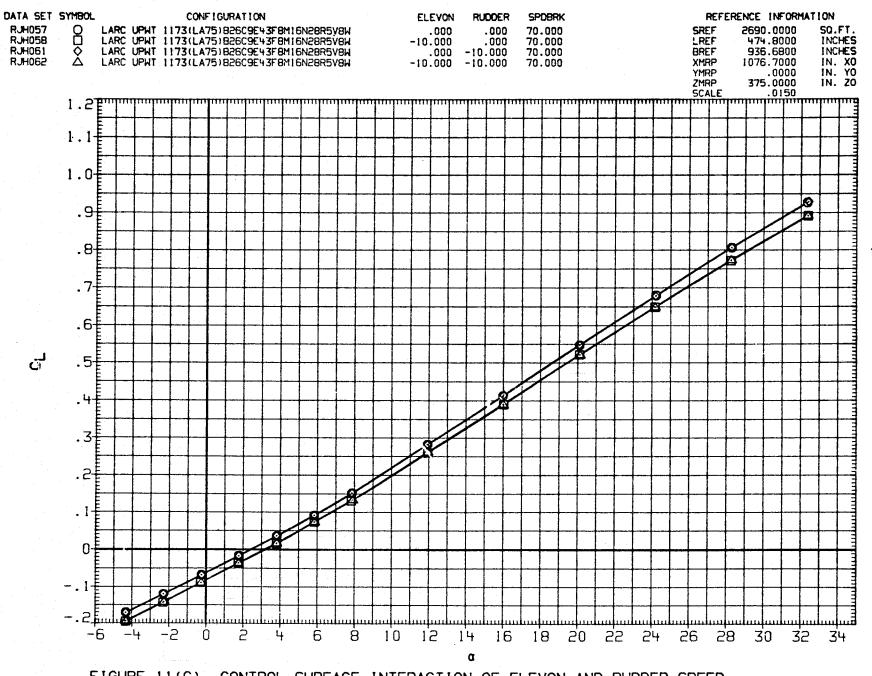


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

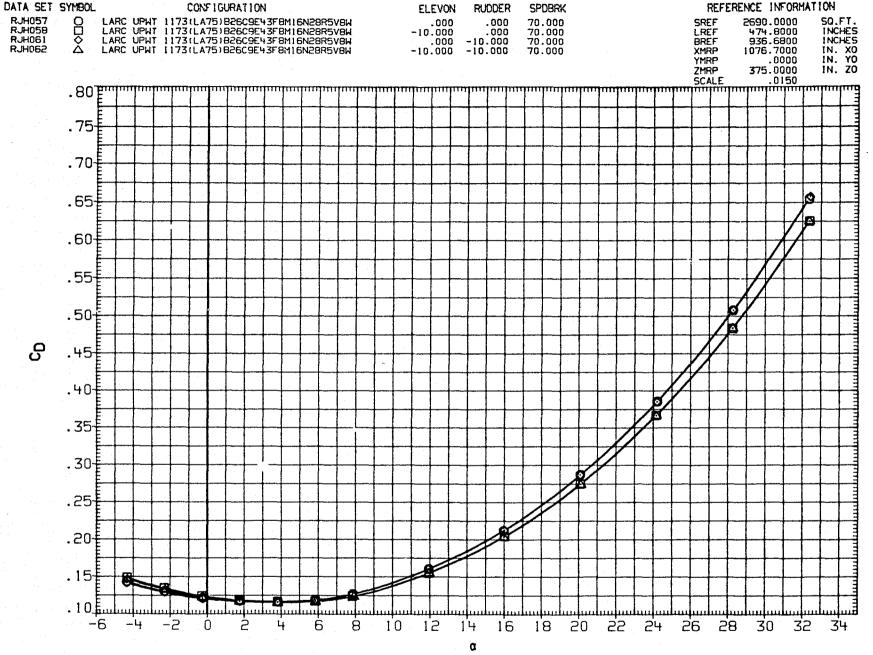


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

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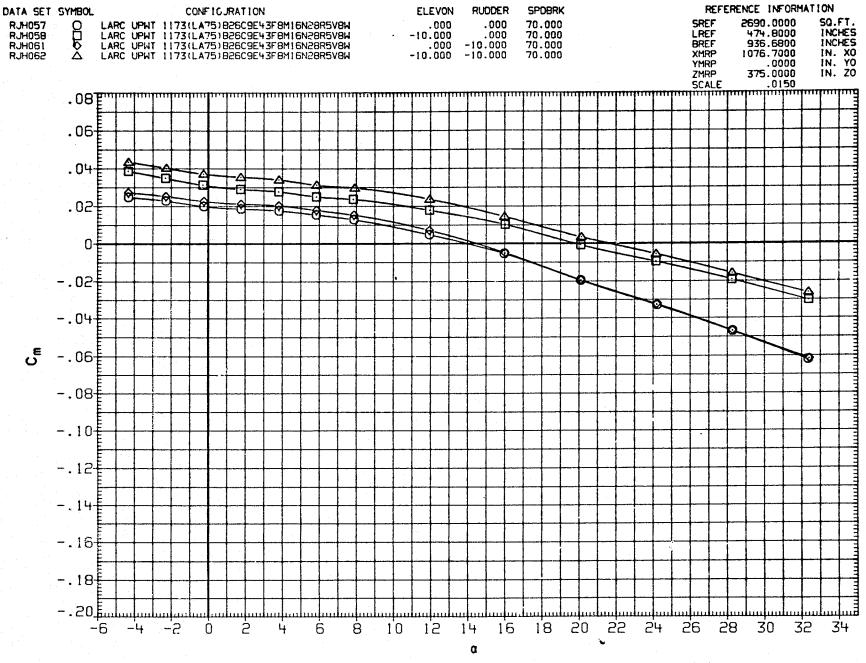
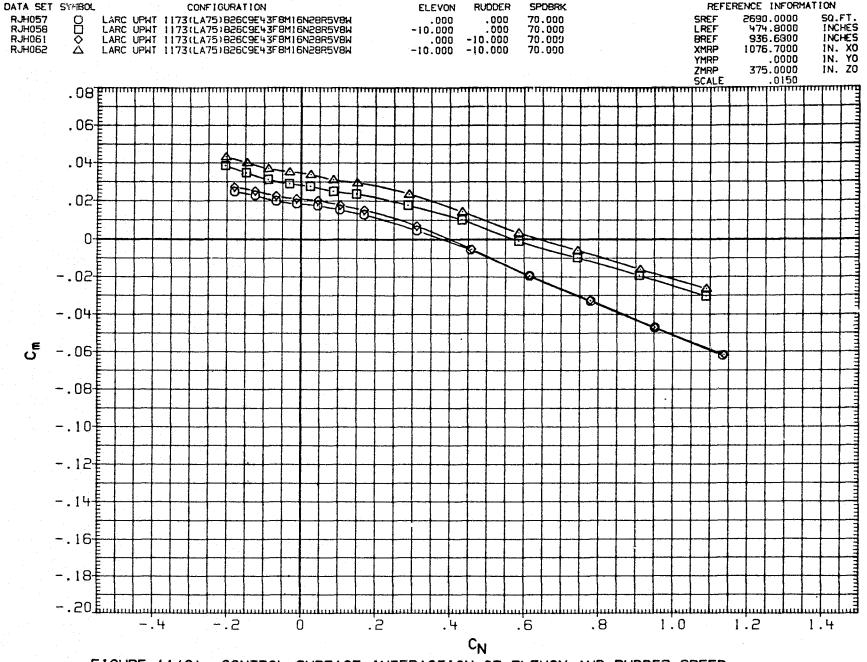


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.



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FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

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REFERENCE INFORMATION



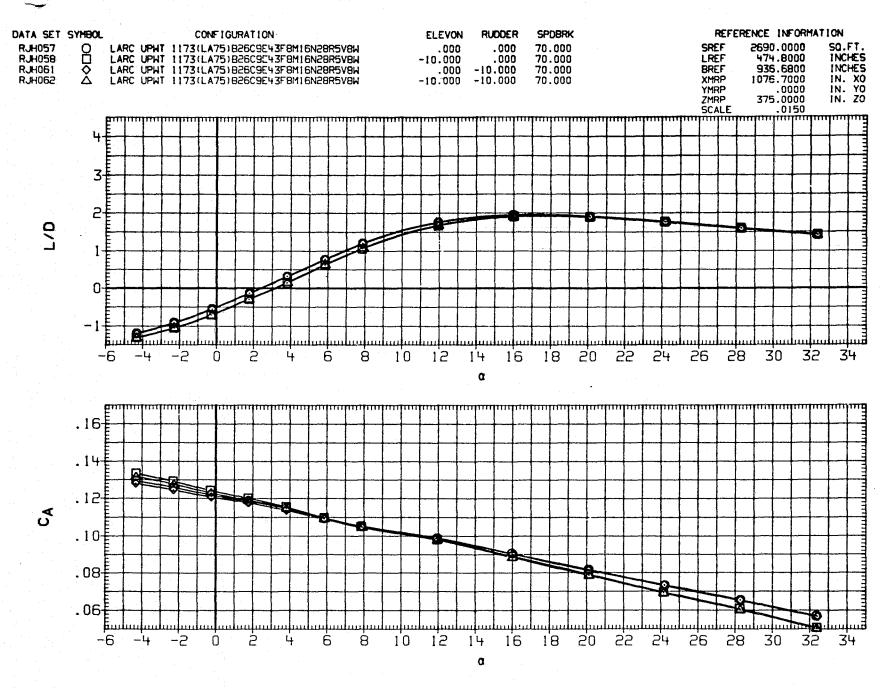


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

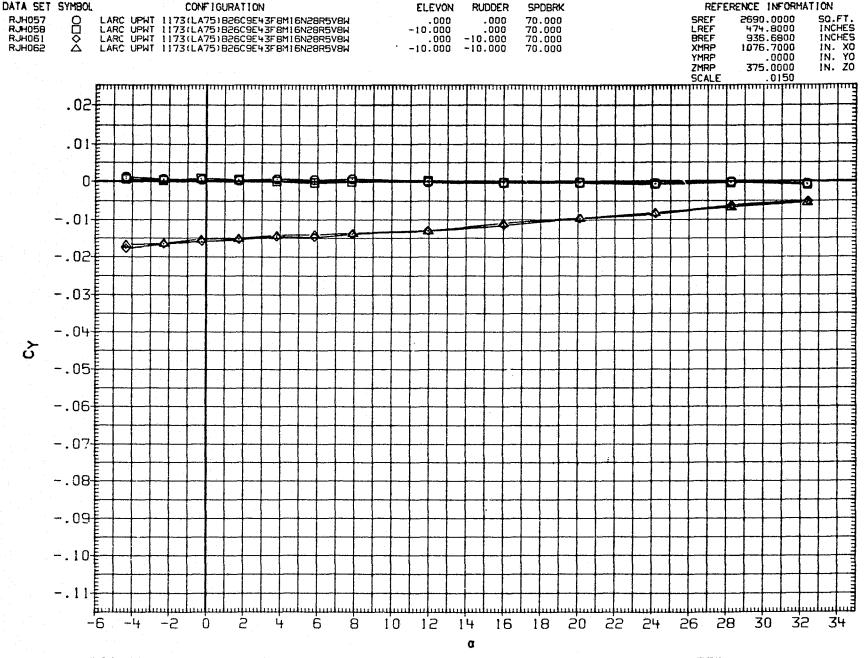


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED

BRAKE AT 70 DEG.

(A) MACH = 2.86

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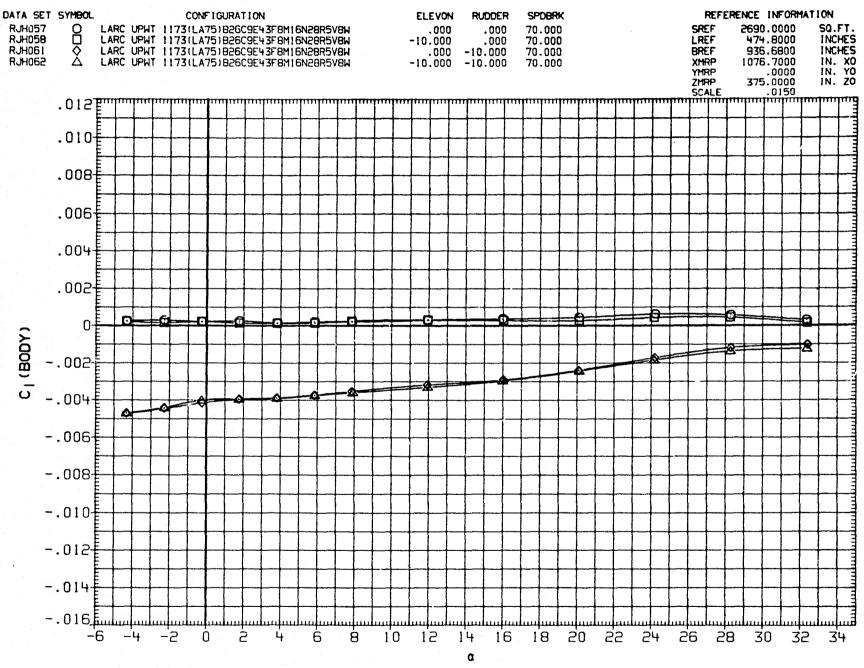


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

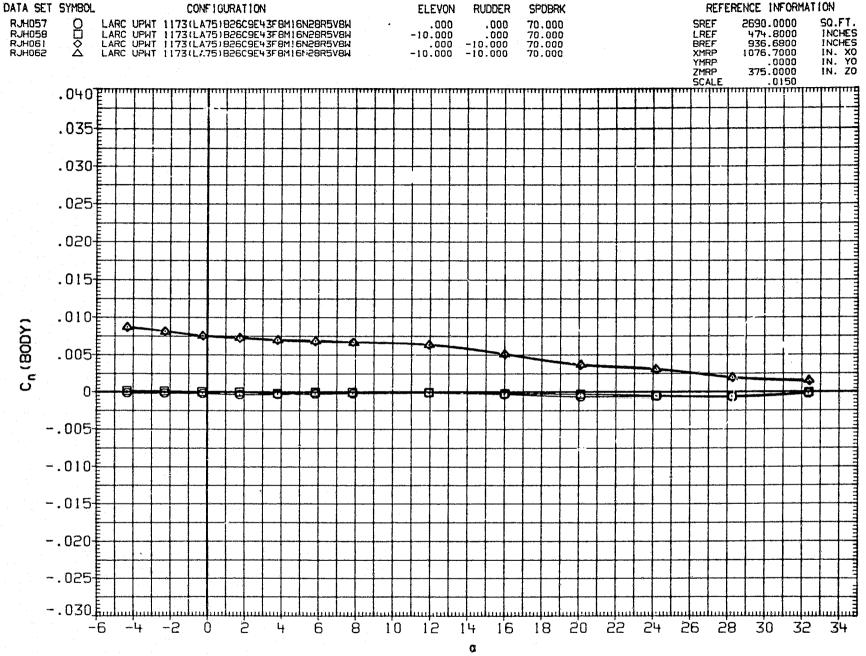


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

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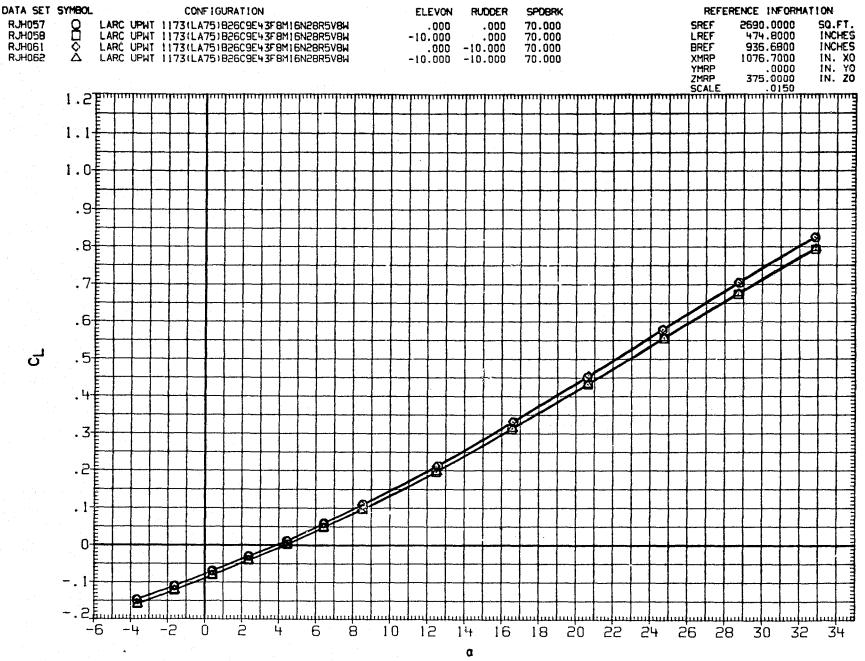


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B)MACH = 3.90

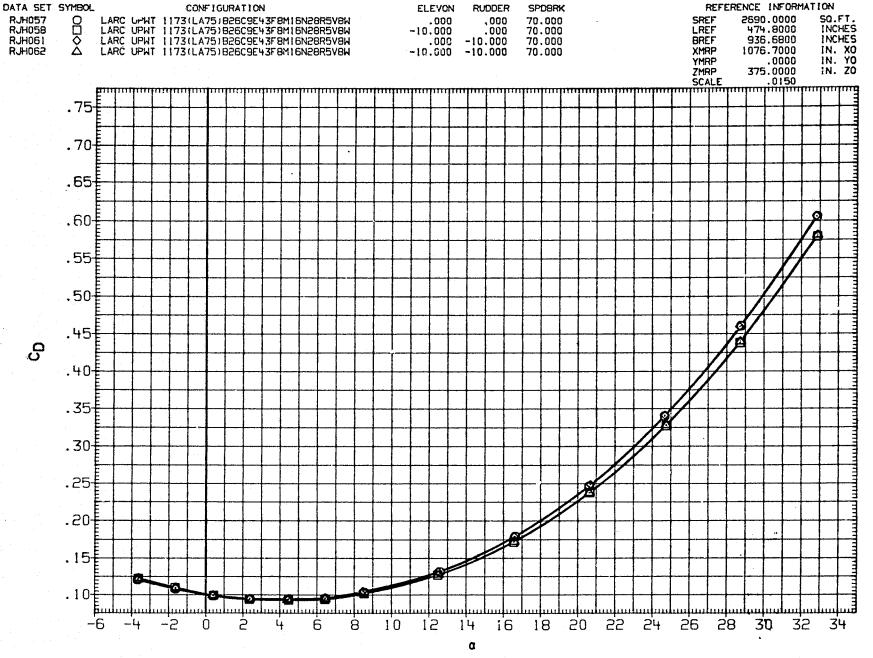


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

298

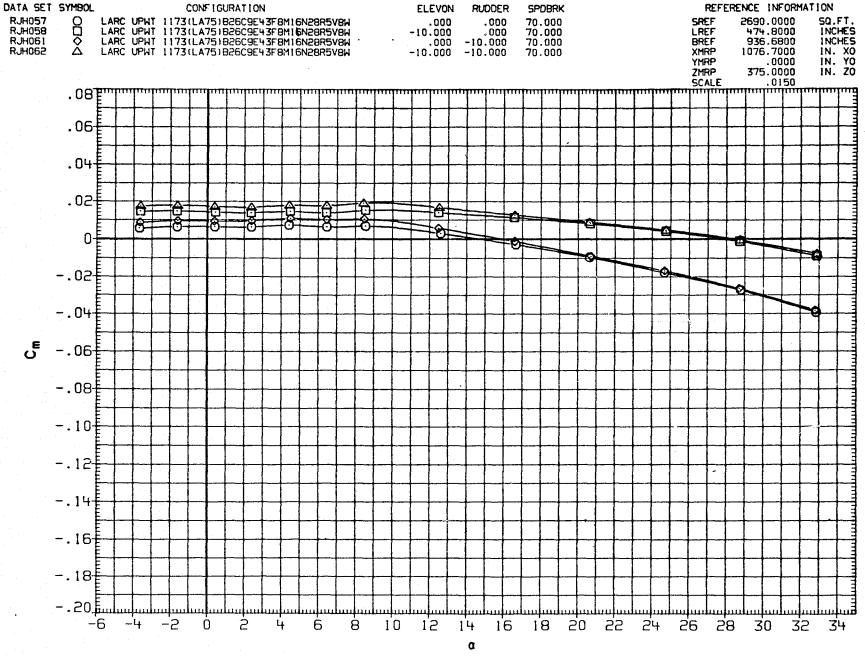


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B)MACH = 3.90

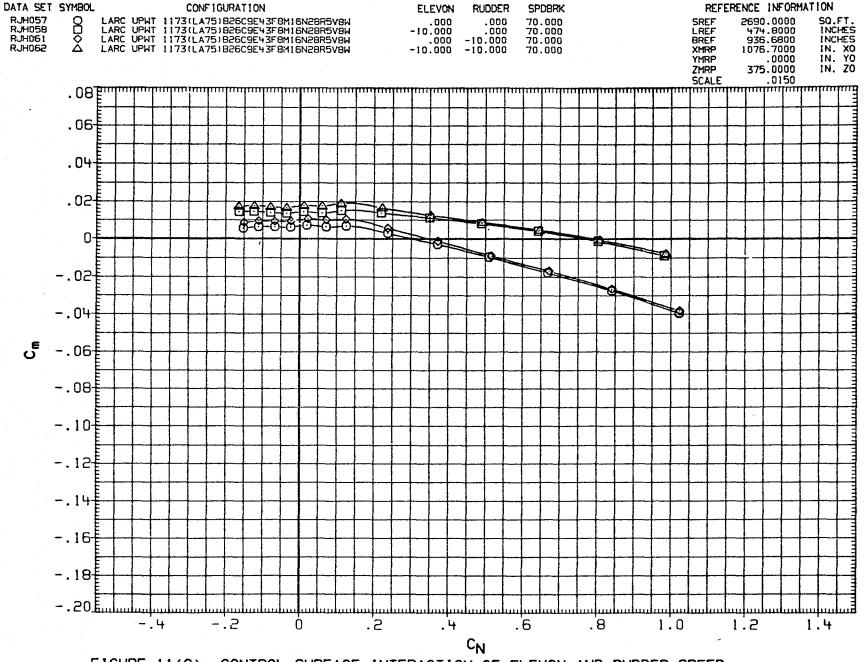


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90 FAGE

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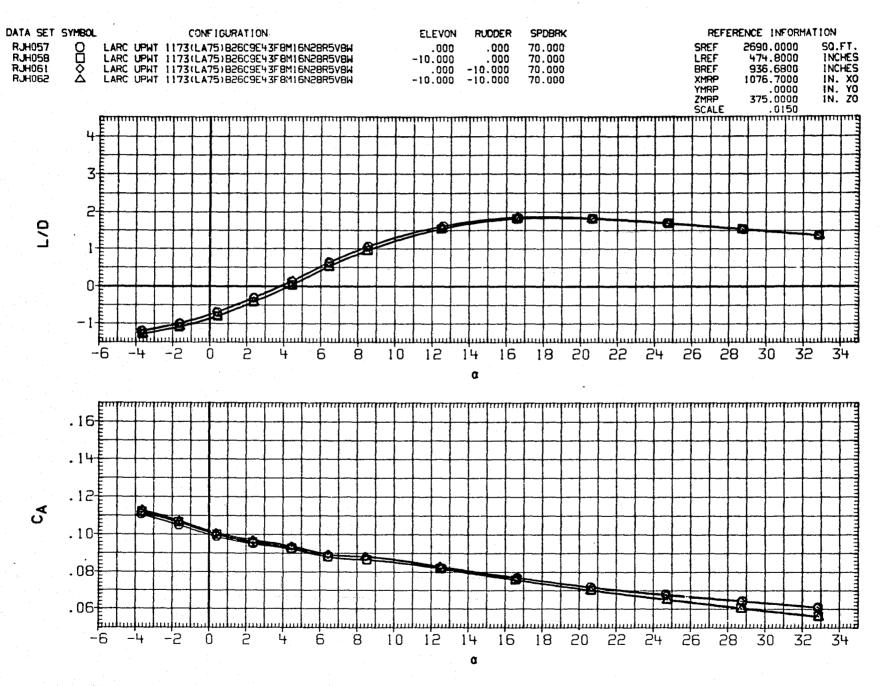


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

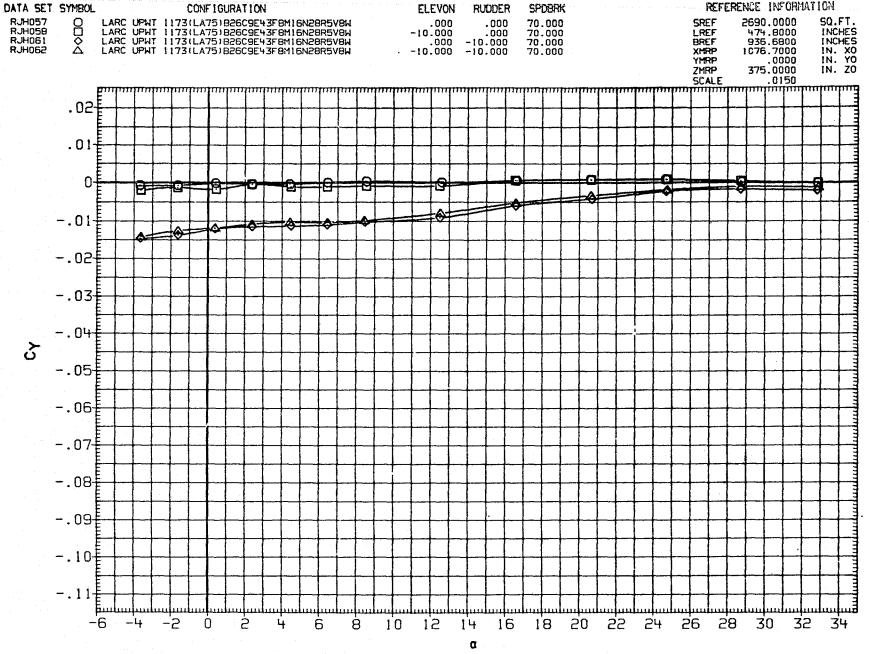


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH 3.90 PAGE 302

REFERENCE INFORMATION

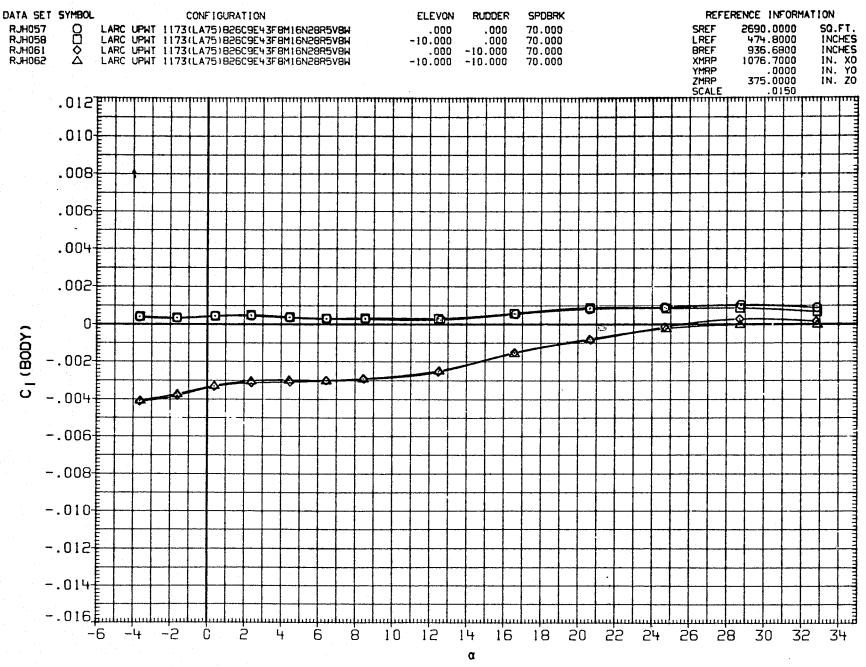


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B)MACH = 3.90

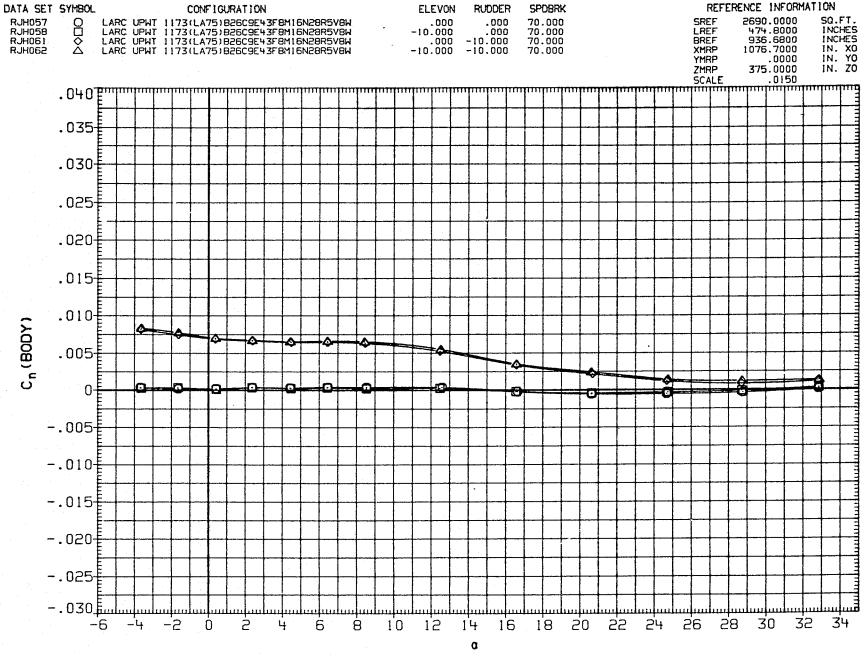
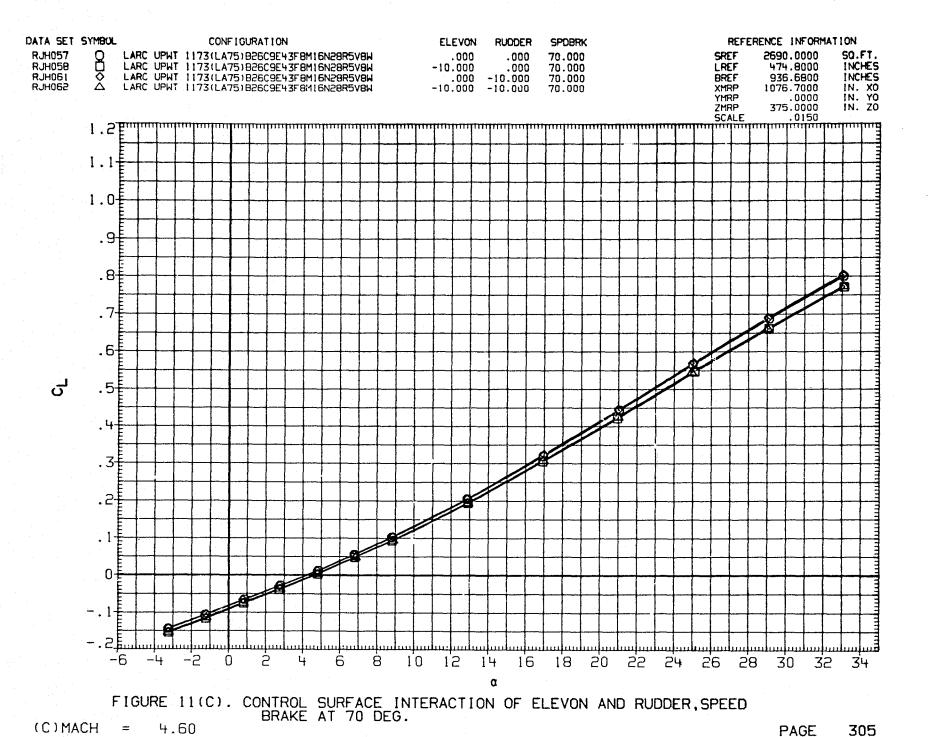


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90



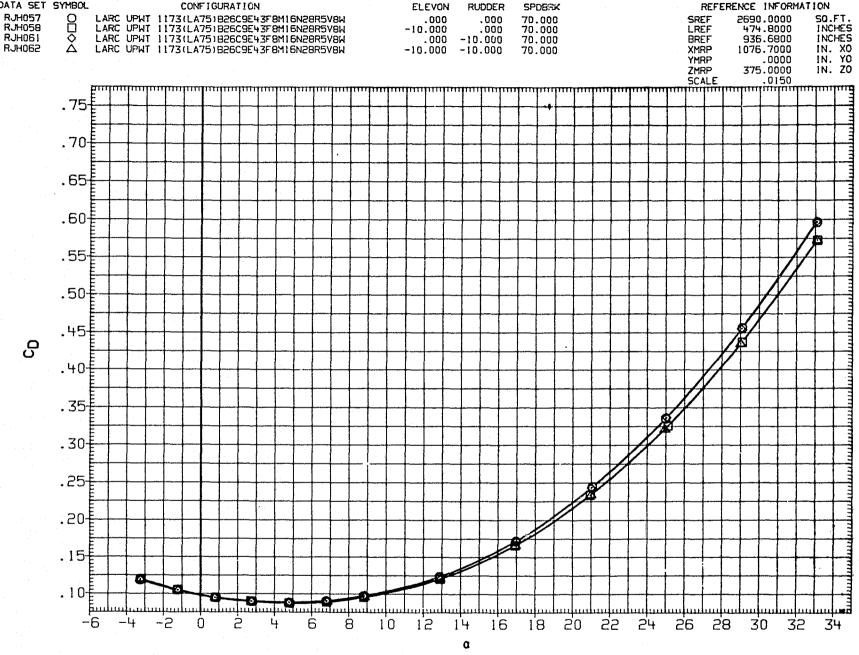


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

DATA SET SYMBOL

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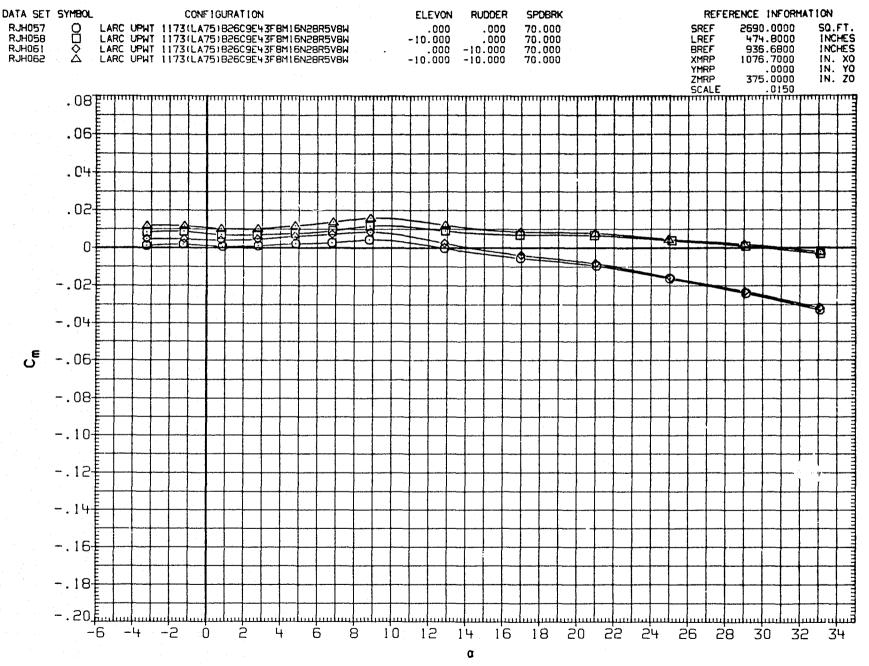


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

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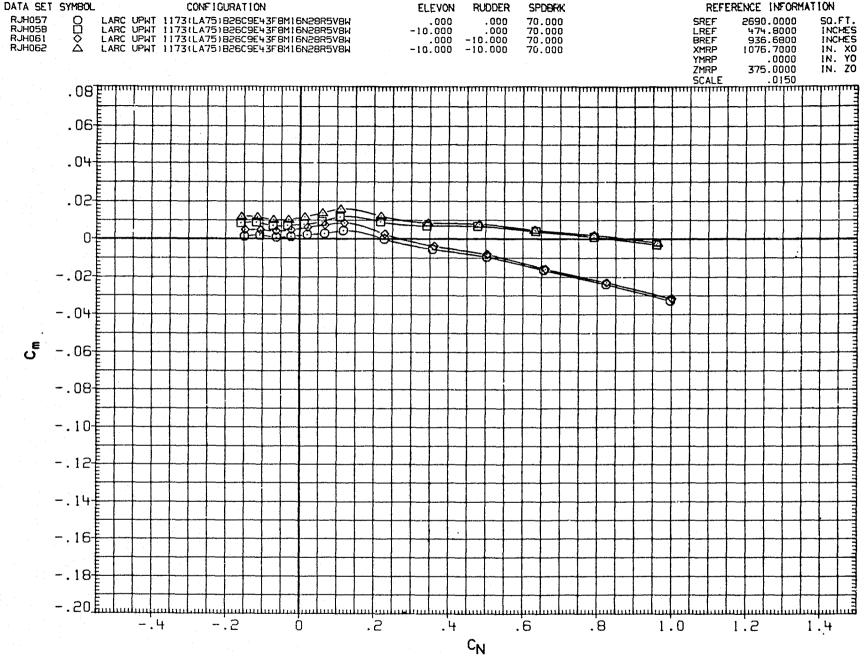


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

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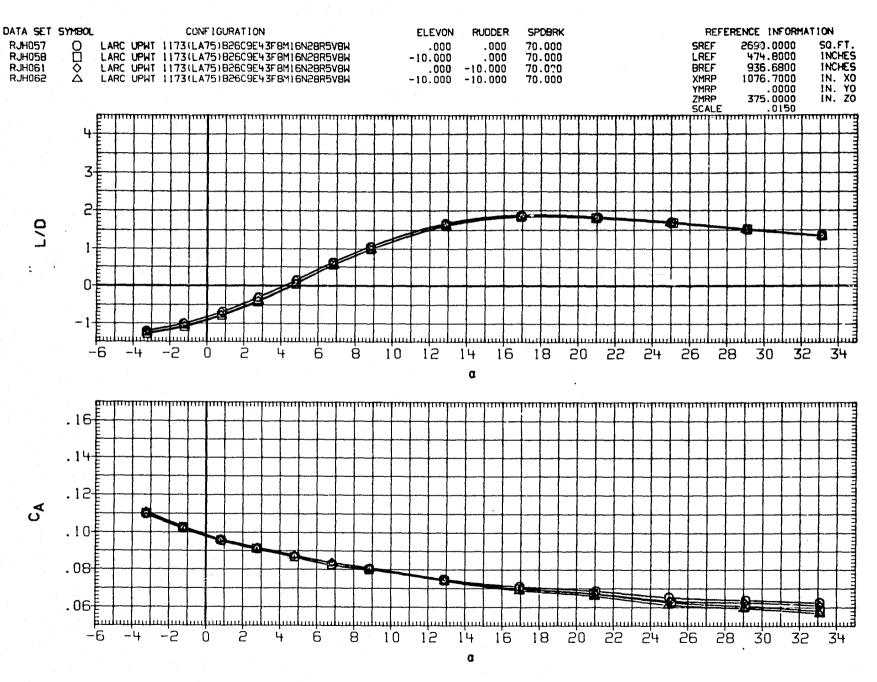


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

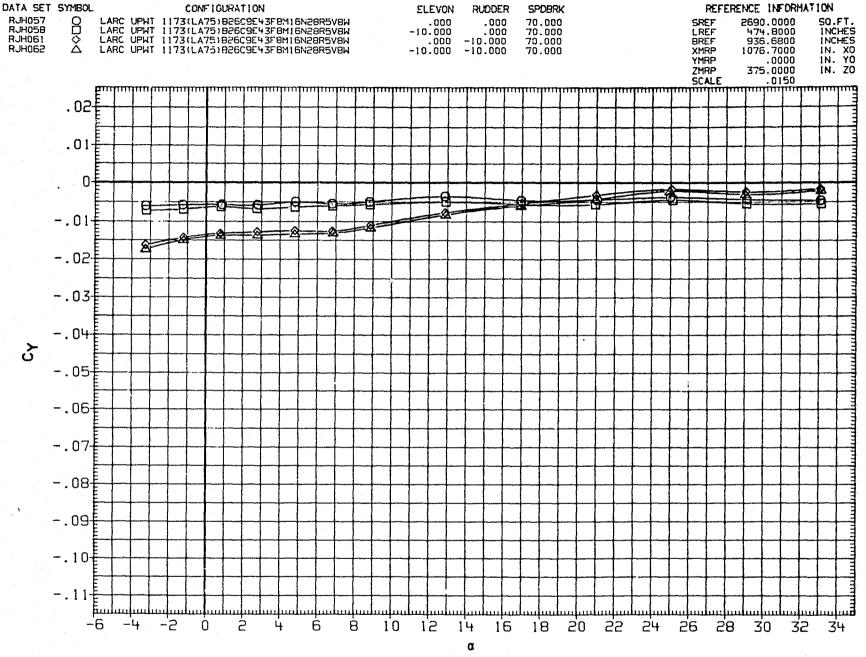


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

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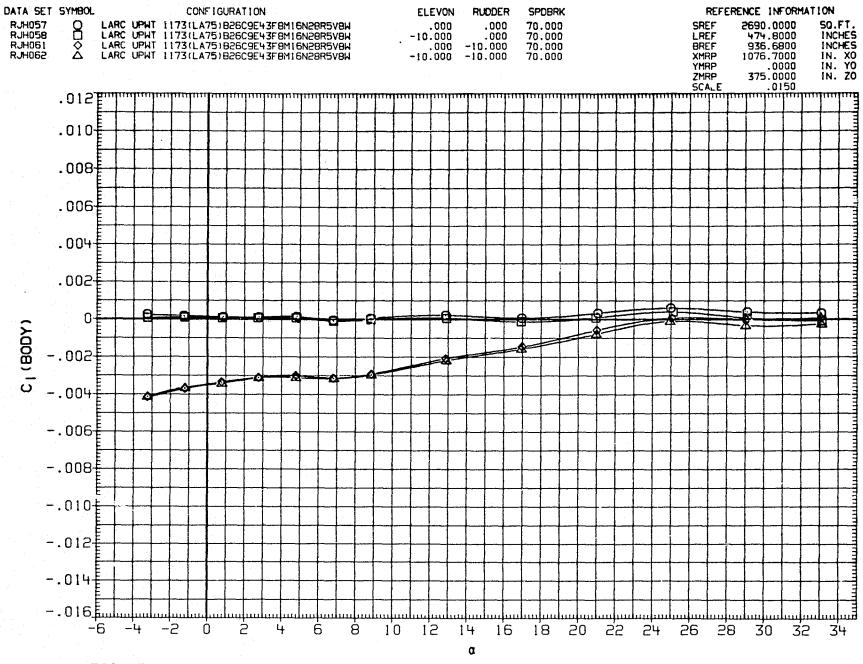


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

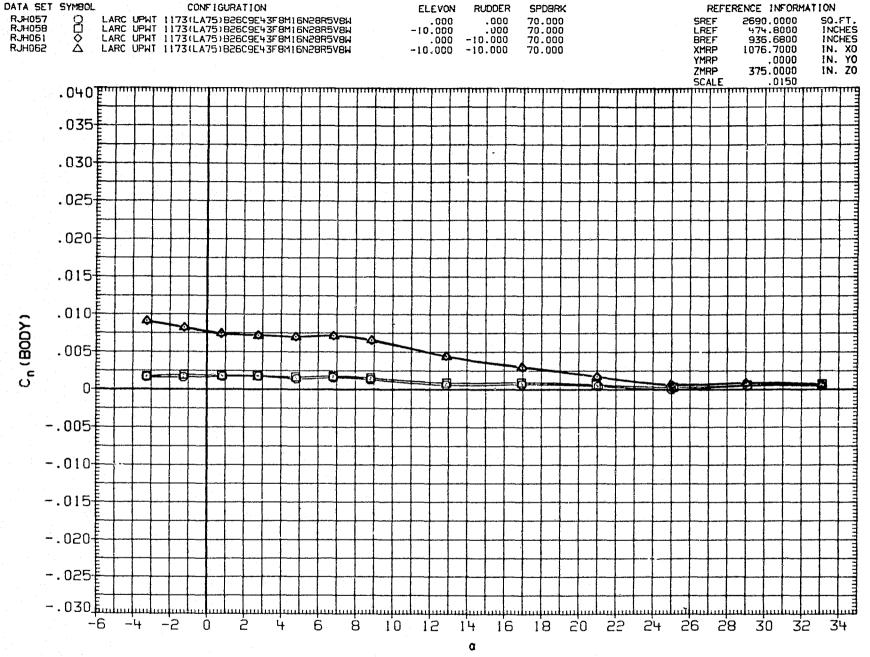


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 70 DEG.

(C) MACH = 4.60

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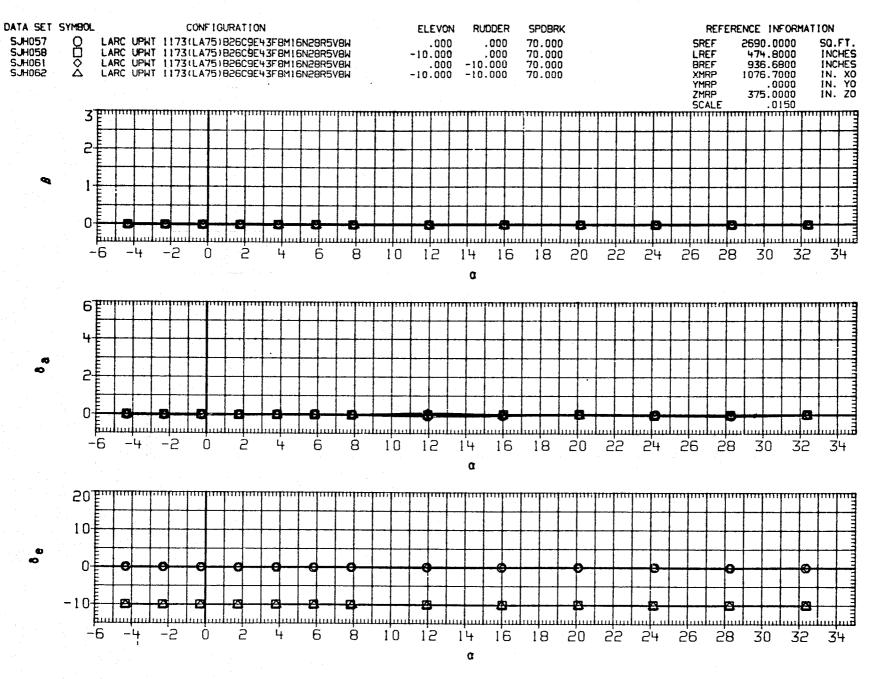


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

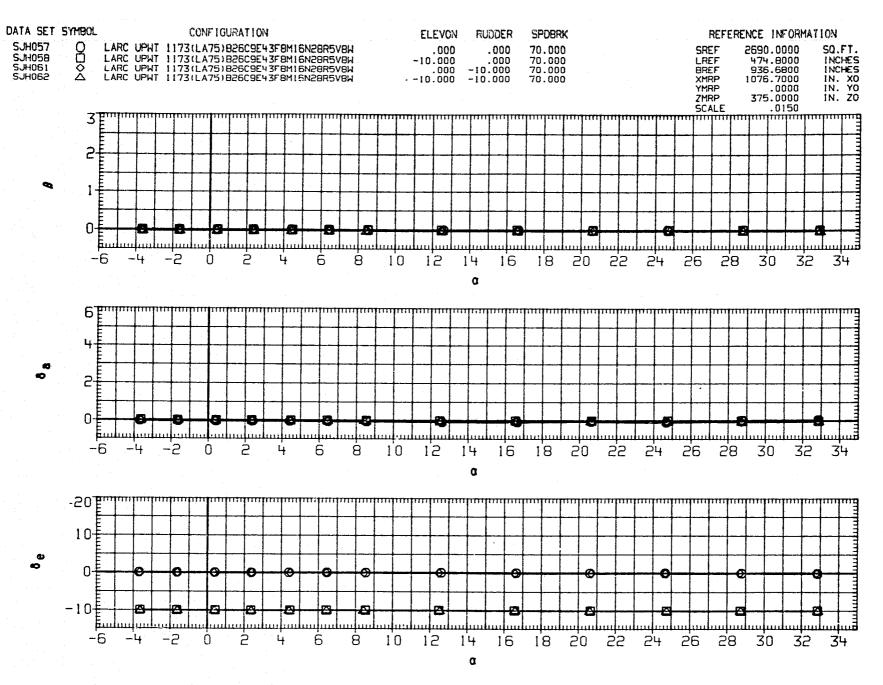


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

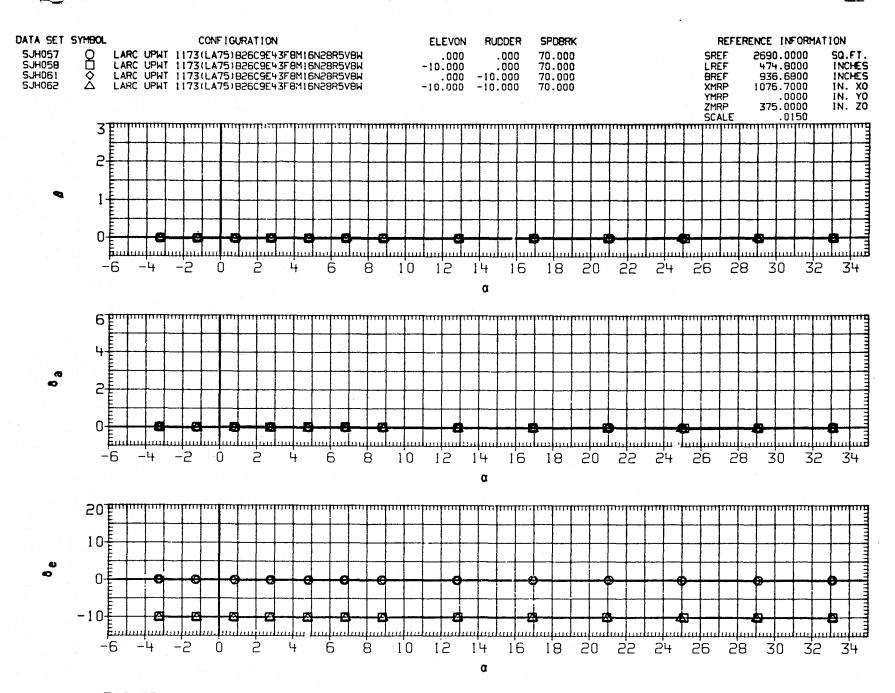


FIGURE 11(C). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 70 DEG.

(C) MACH

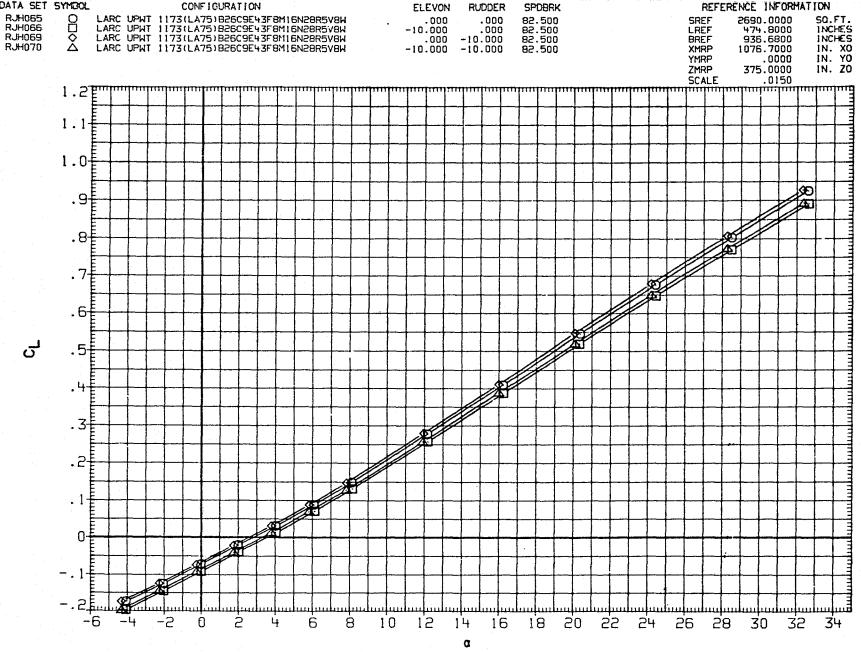


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A)MACH =2.86

DATA SET SYMBOL

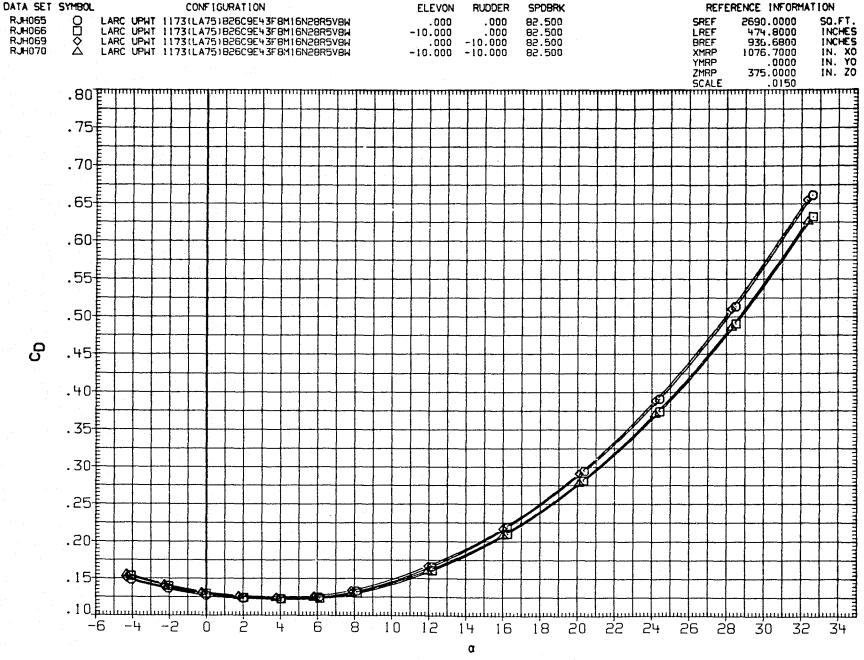


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A)MACH = 2.86

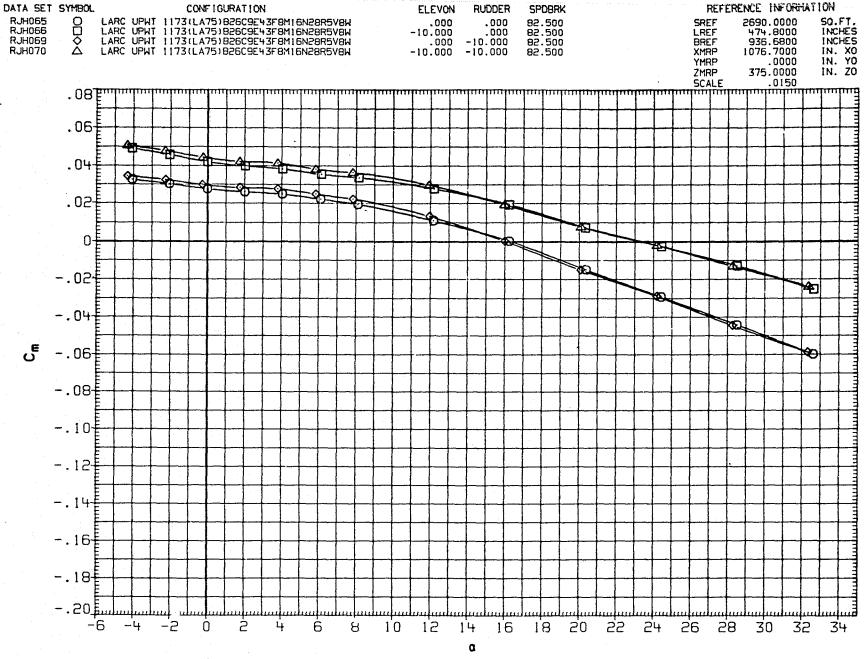
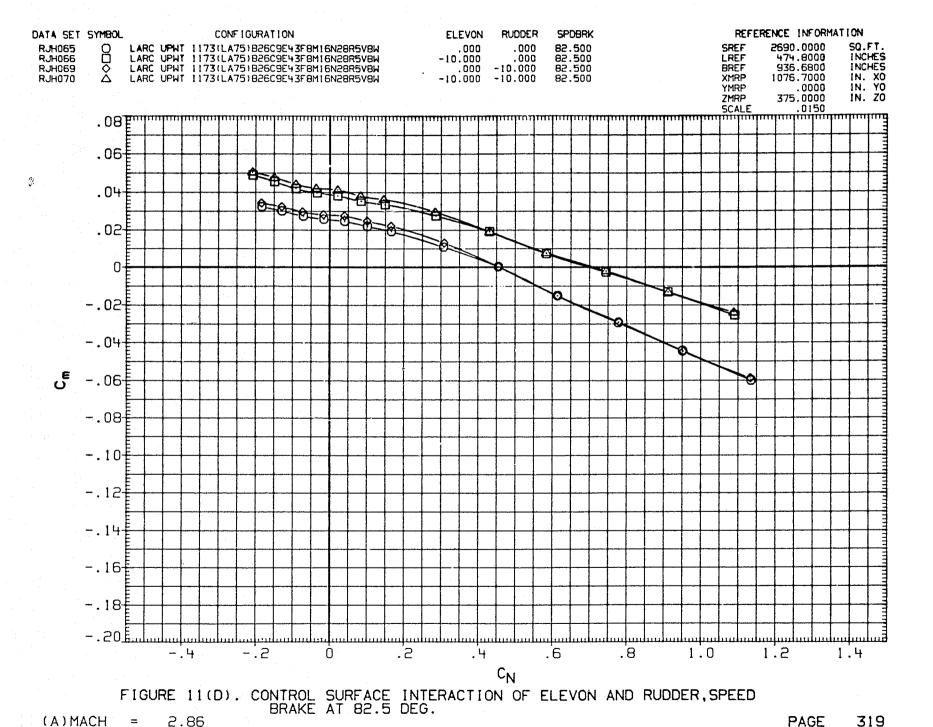


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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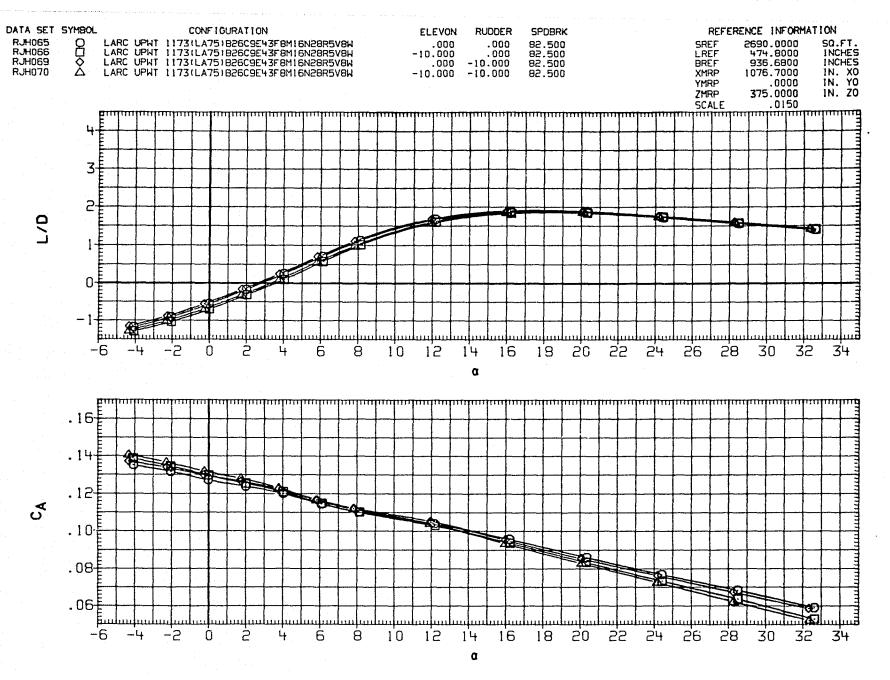


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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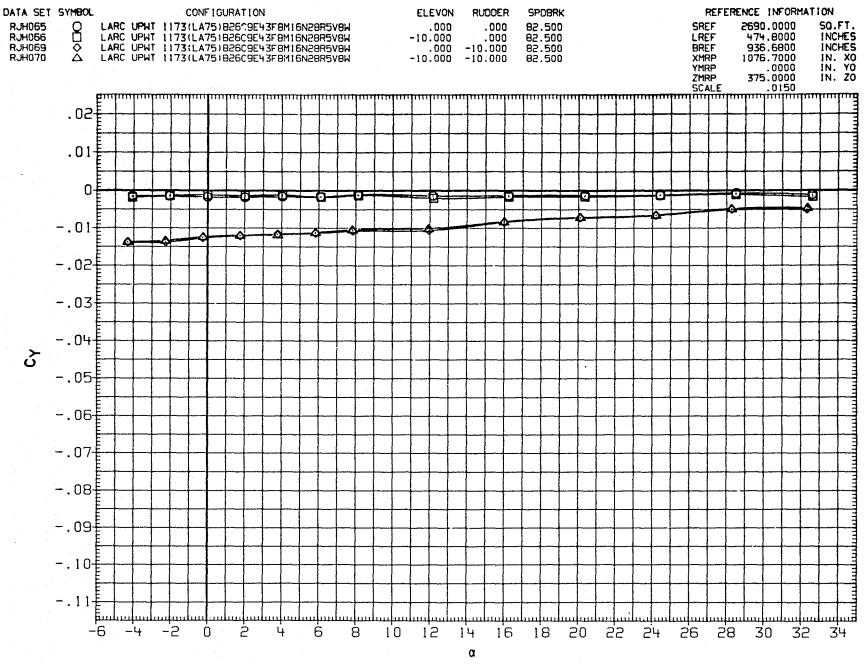


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A)MACH = 2.86

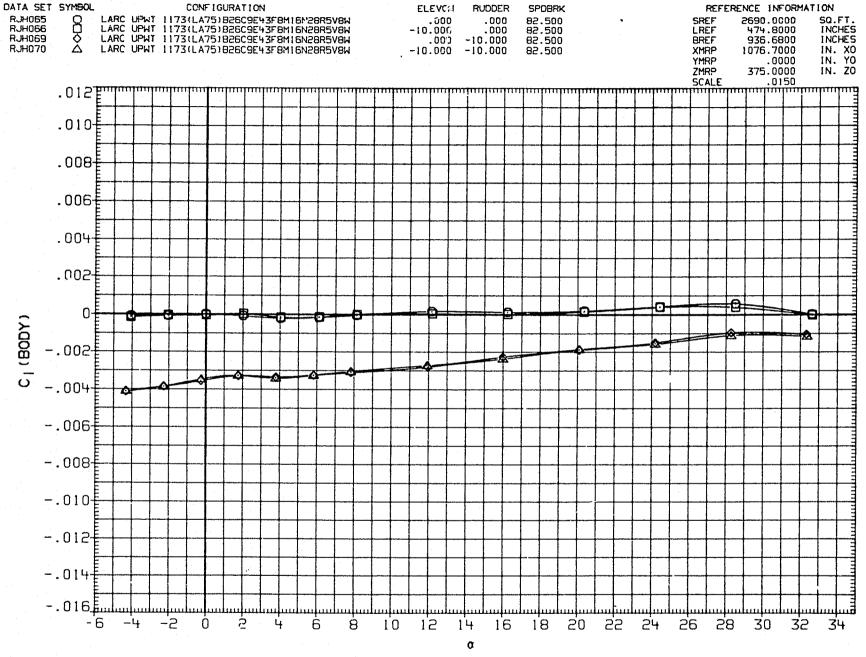


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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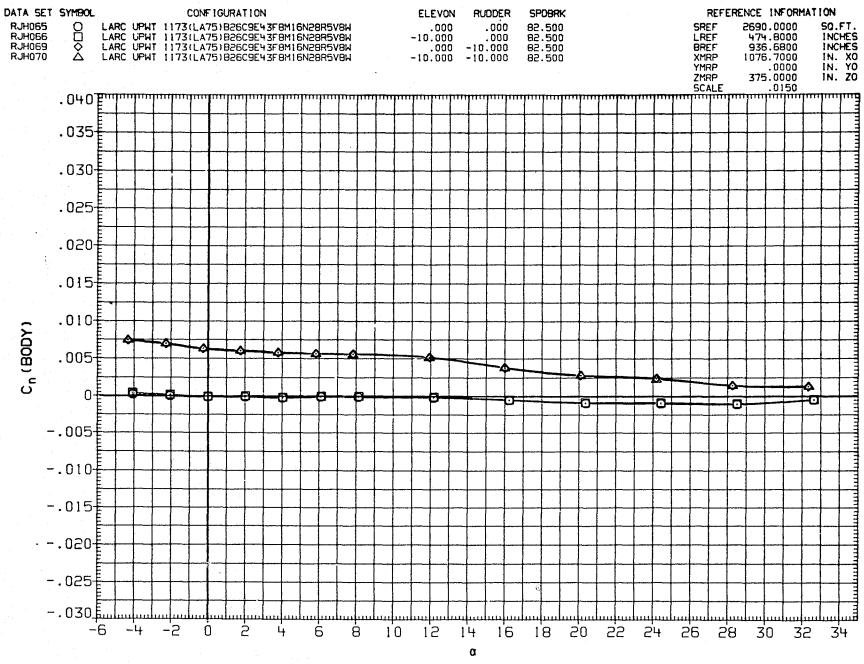


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

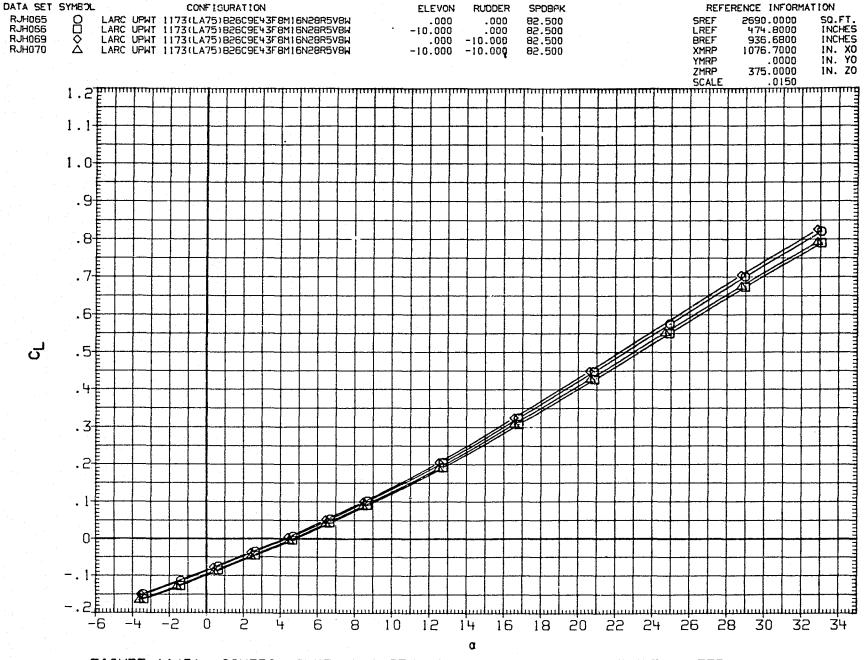


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 82.5 DEG.

(B) MACH = 3.90

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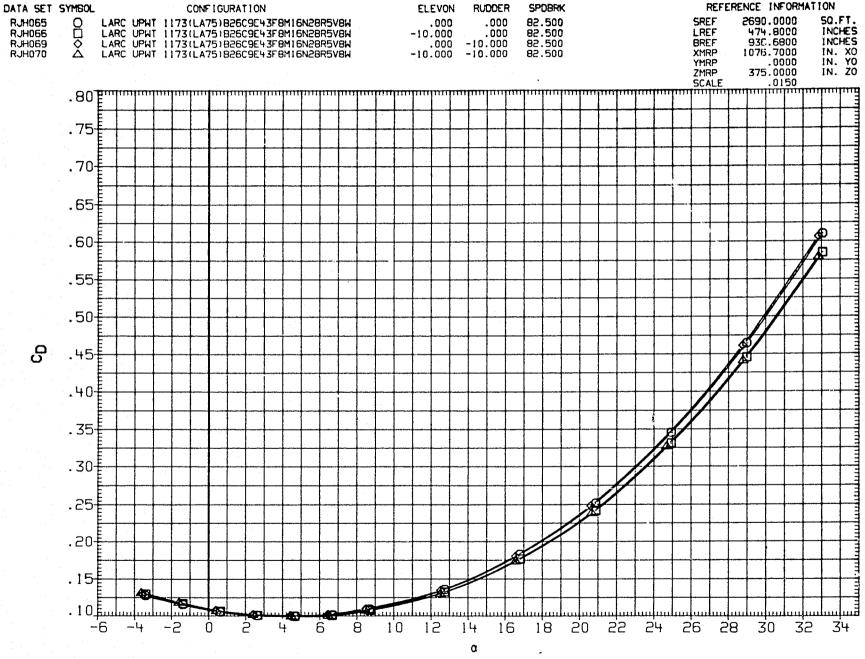


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG. (B)MACH =

3.90

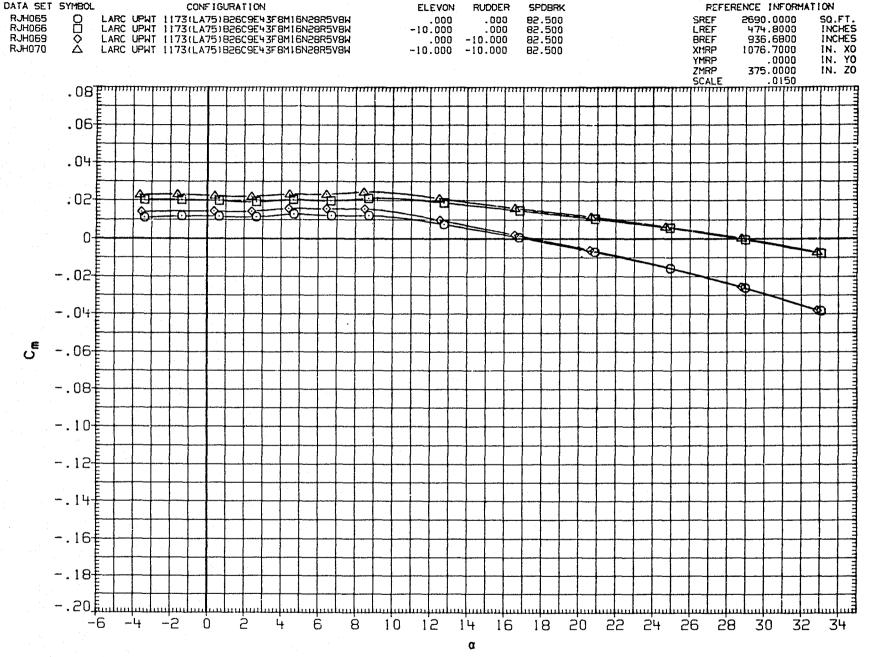


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 82.5 DEG.

(B) MACH = 3.90

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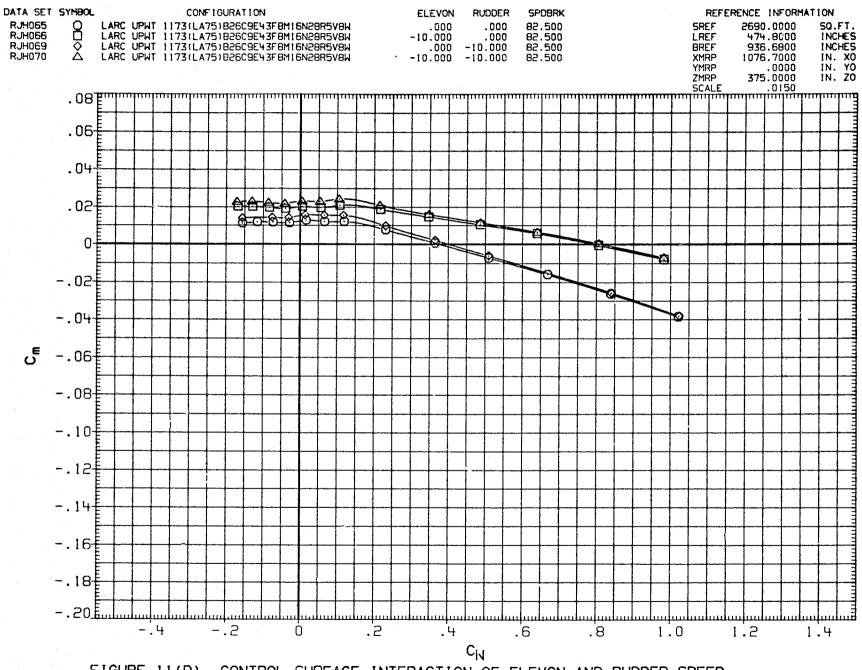


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B)MACH = 3.90

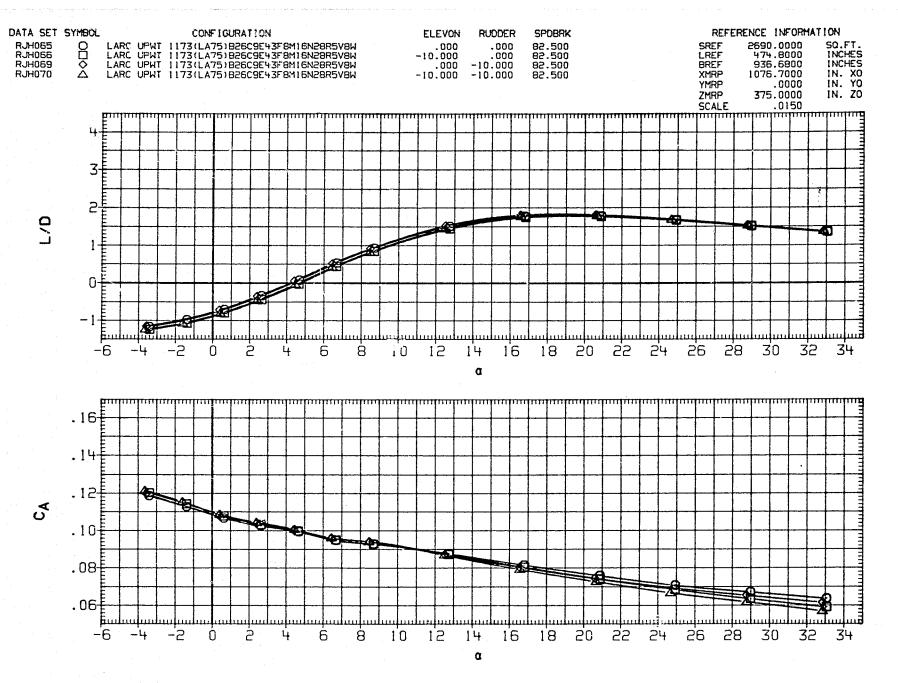


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90

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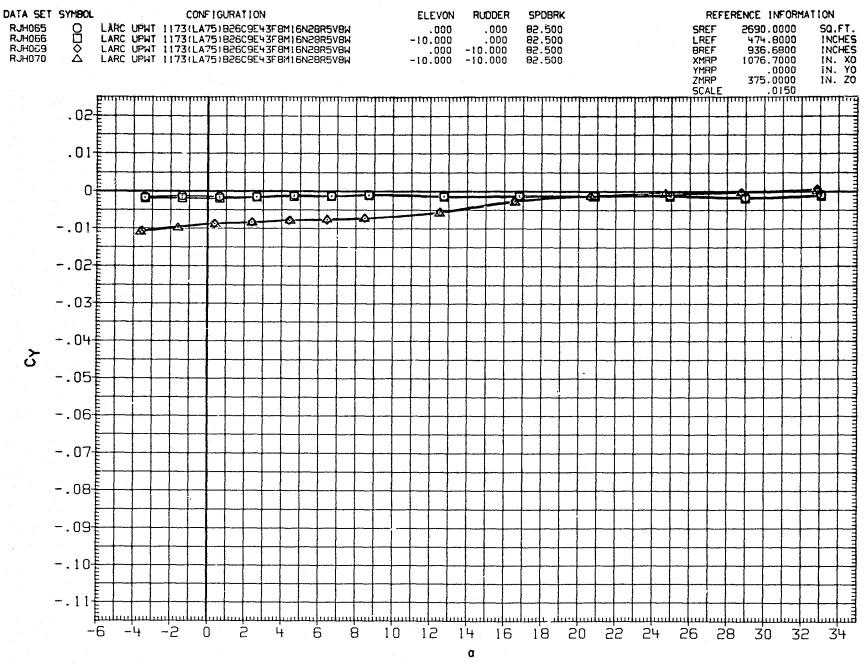
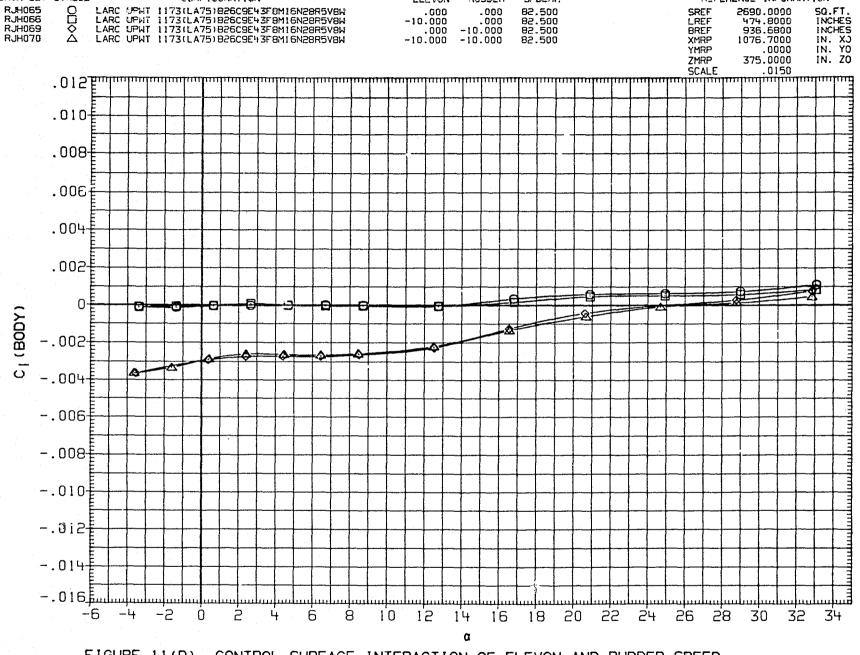


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90



ELEVON

RUDDER

SPORK!

REFERENCE INFORMATION

DATA SET SYMBOL

CONFIGURATION

FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90 PAGE

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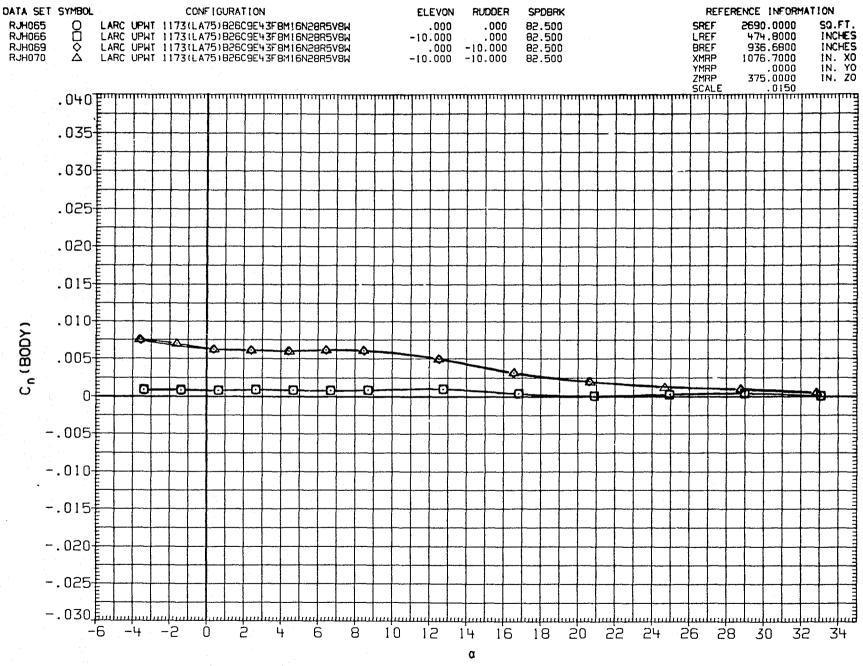
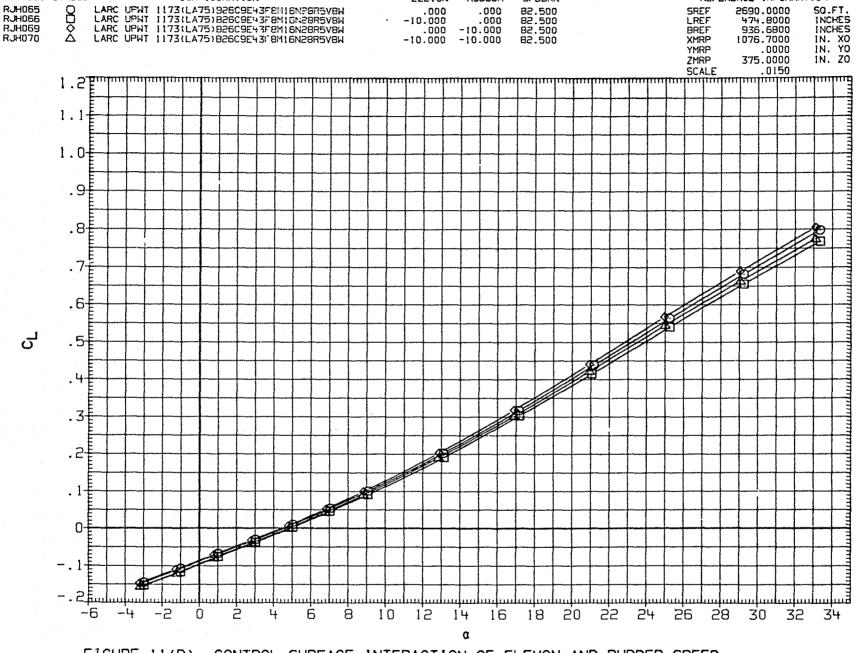


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90



ELEVON RUDDER

SPDBRK

REFERENCE INFORMATION

DATA SET SYMBOL

CONFIGURATION

FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 82.5 DEG.
(C) MACH = 4.60
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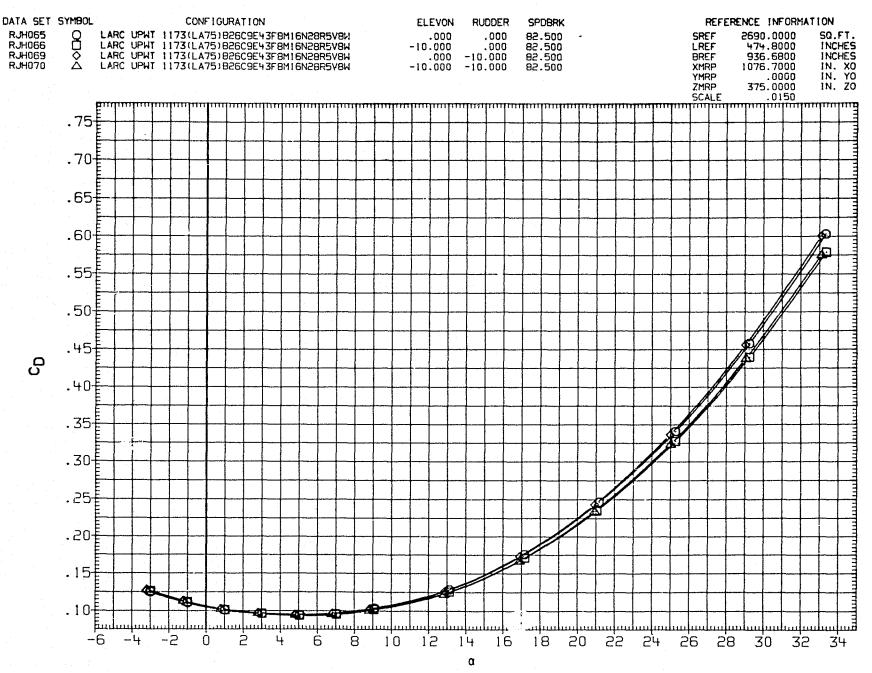


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C)MACH = 4.60

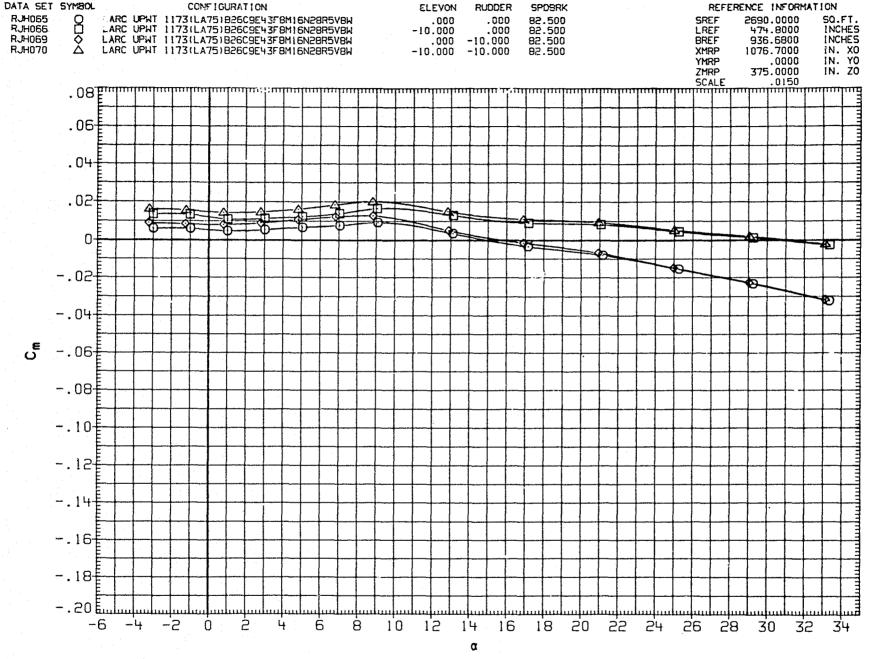


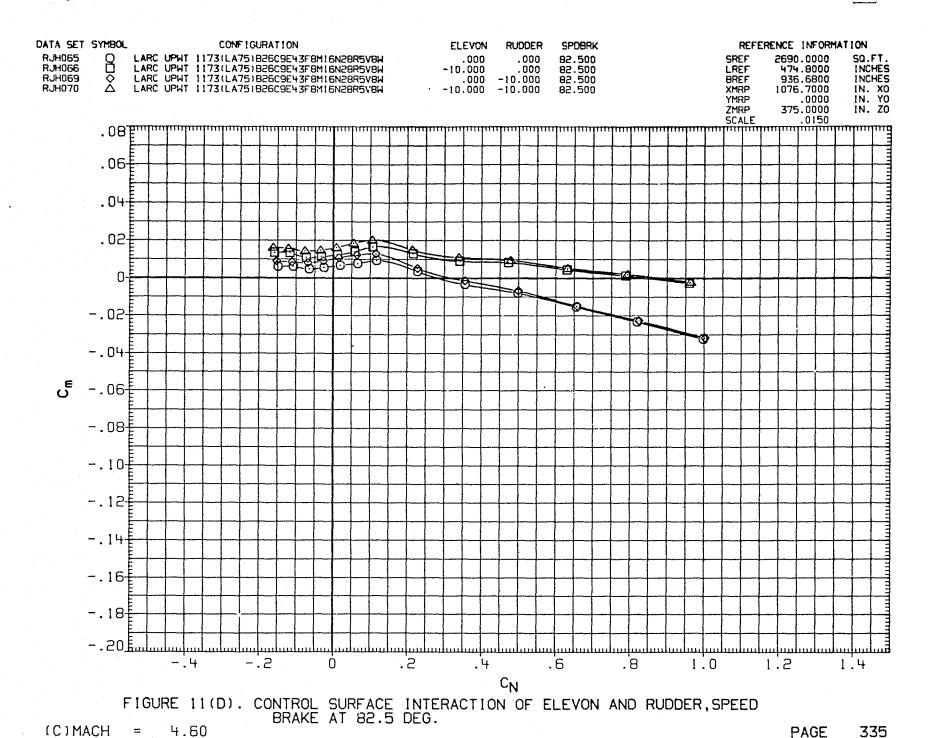
FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED
BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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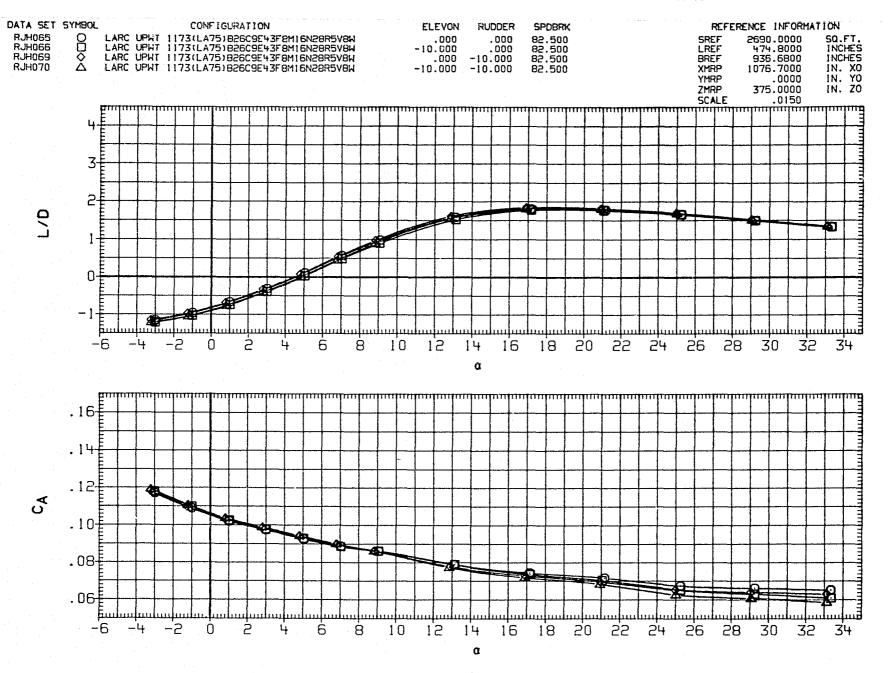


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

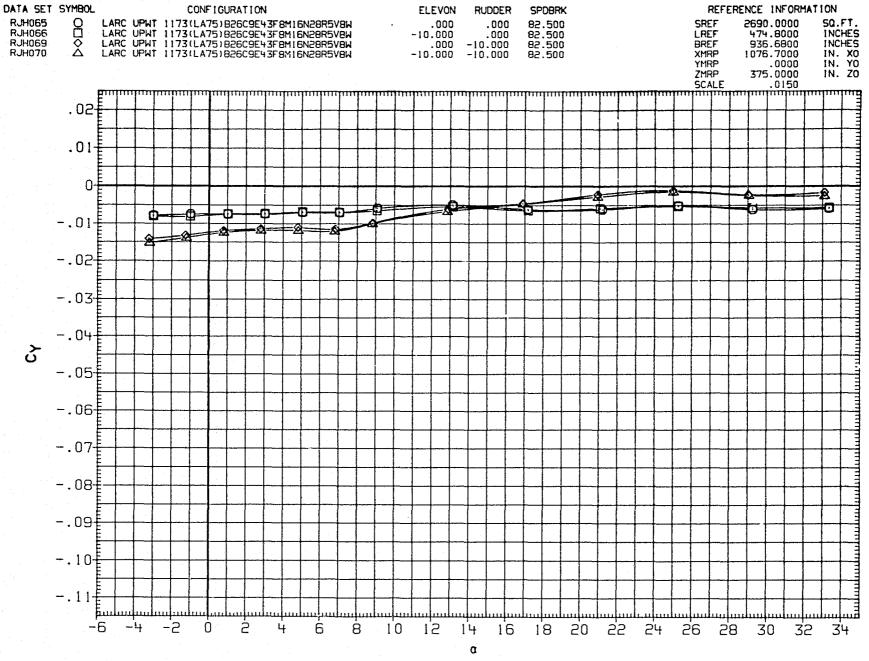


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C)MACH = 4.60

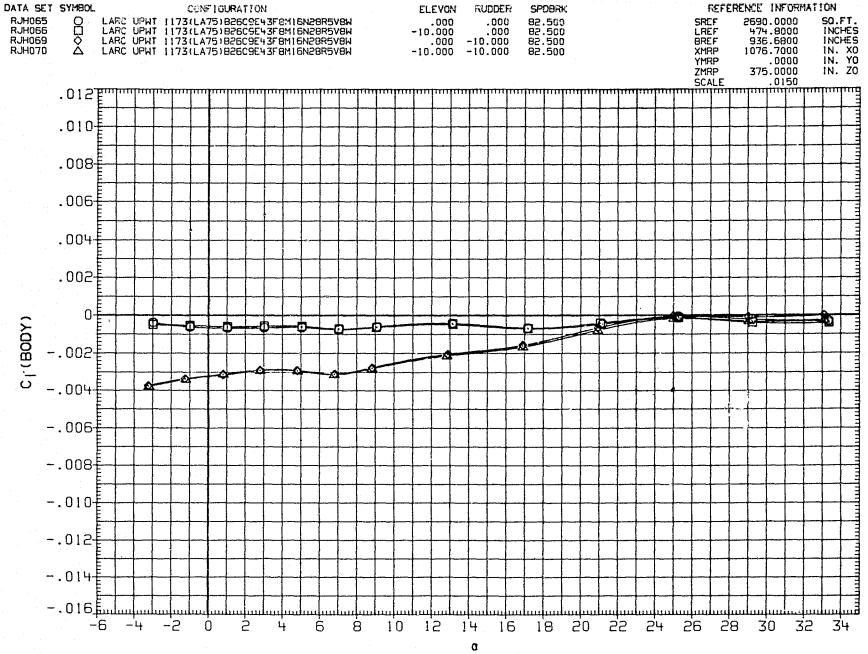


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C) MACH

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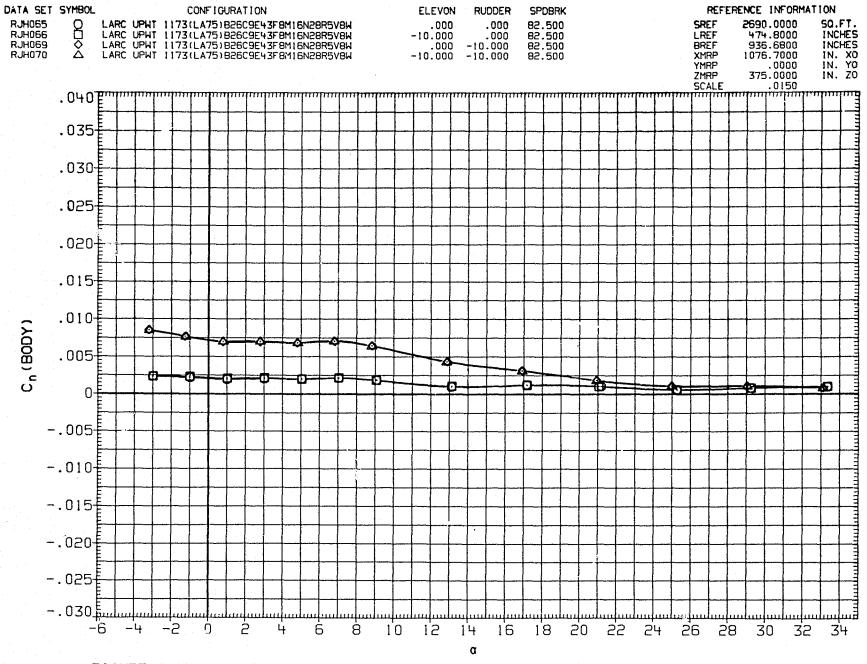


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C)MACH = 4.60

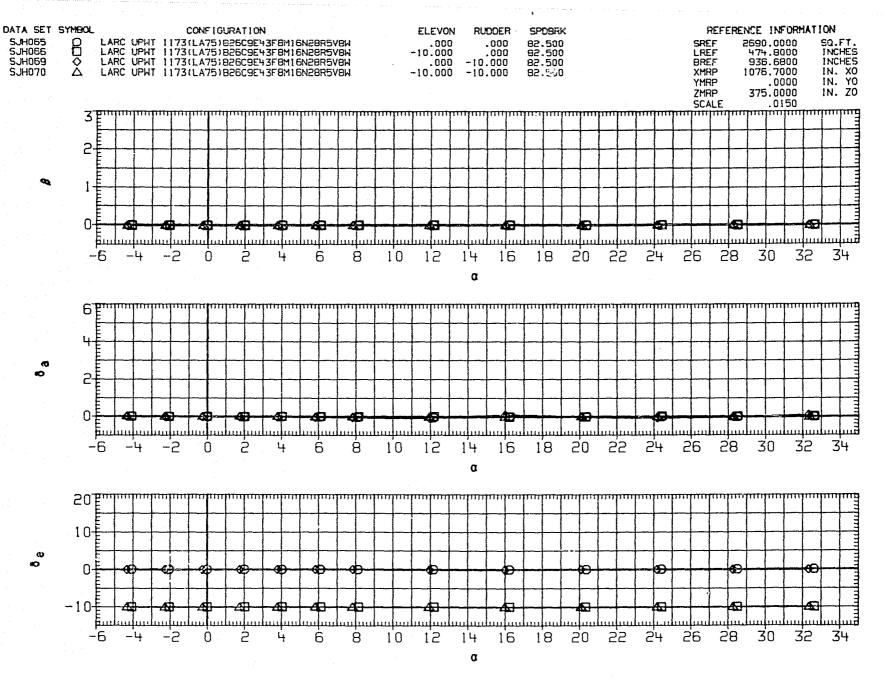


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86



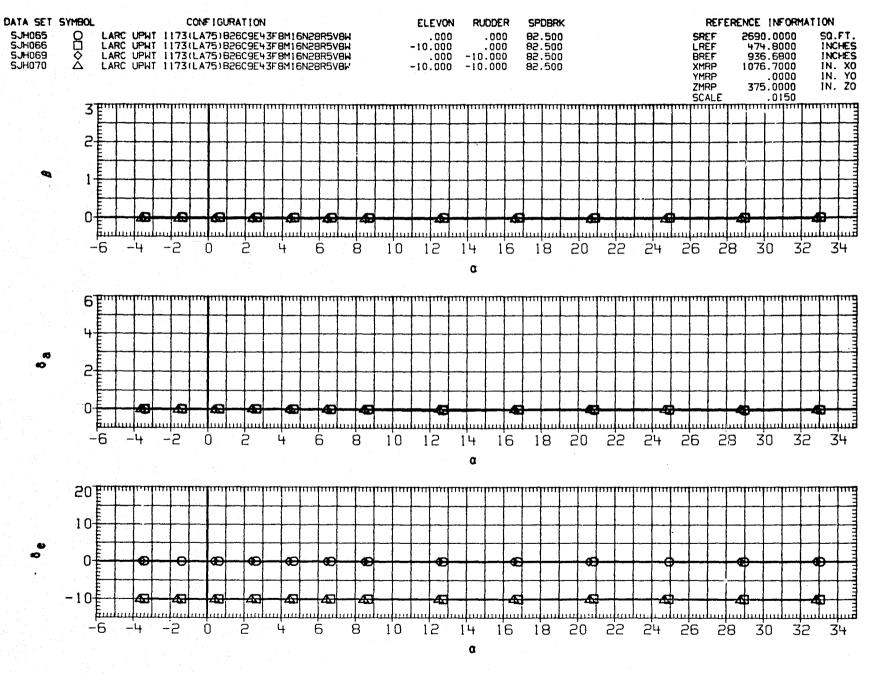


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(B)MACH = 3.90

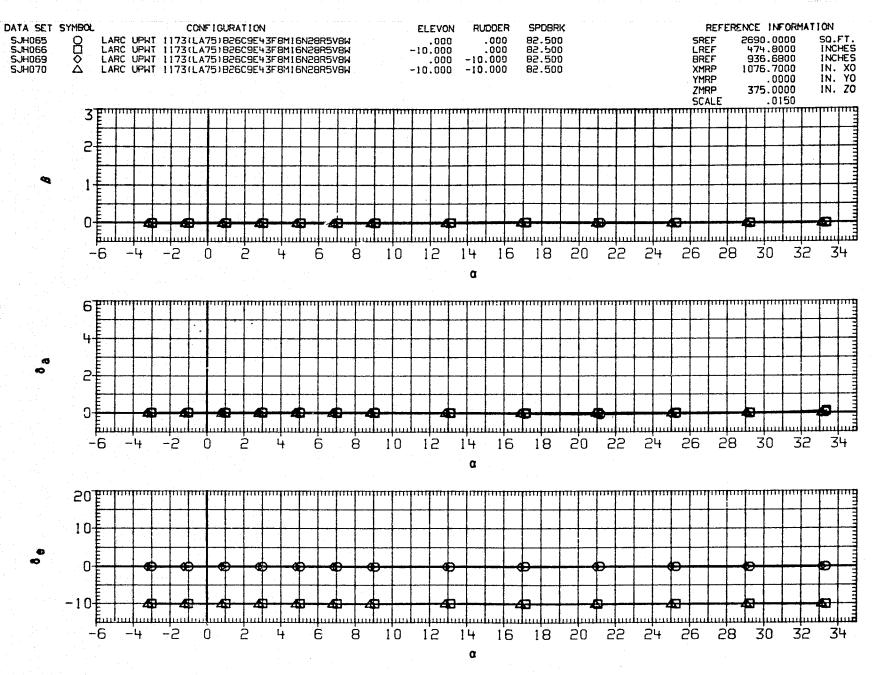


FIGURE 11(D). CONTROL SURFACE INTERACTION OF ELEVON AND RUDDER, SPEED BRAKE AT 82.5 DEG.

(C)MACH = 4.60

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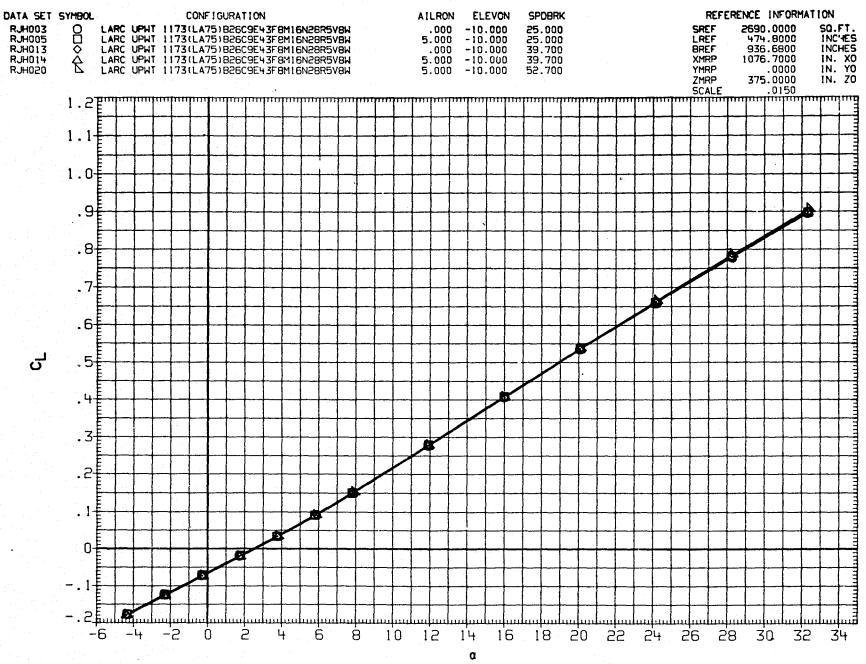


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

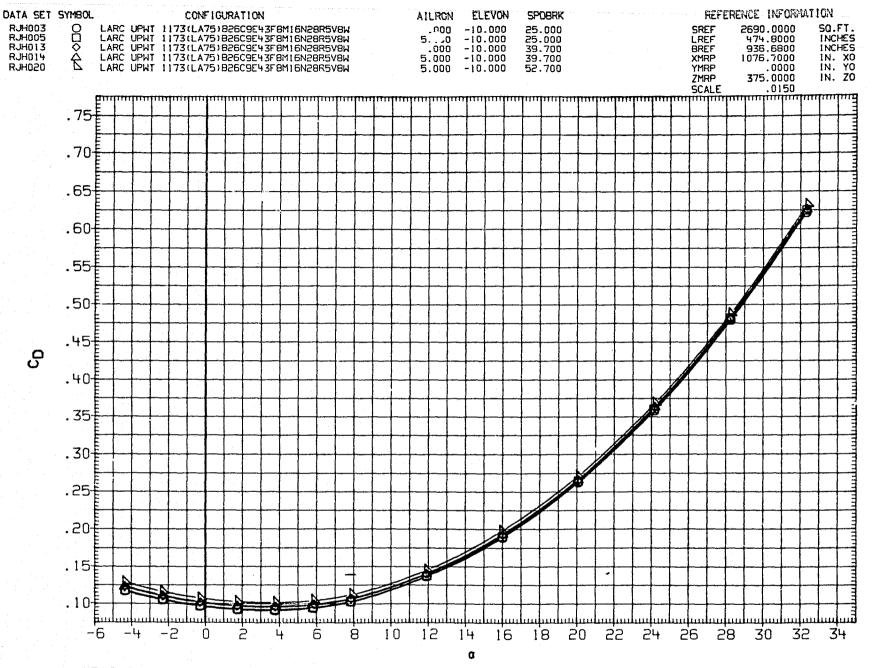


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

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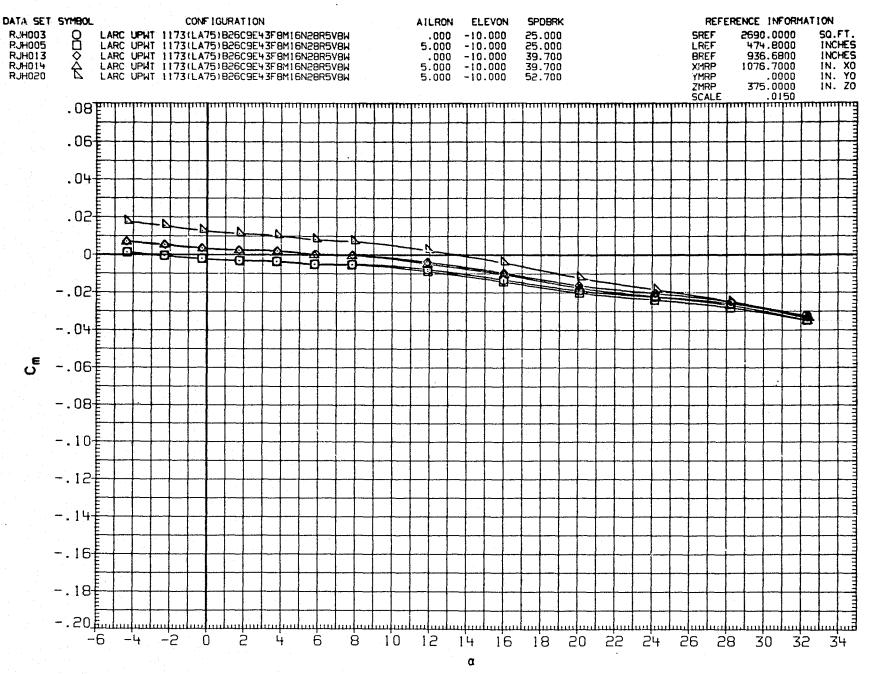


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

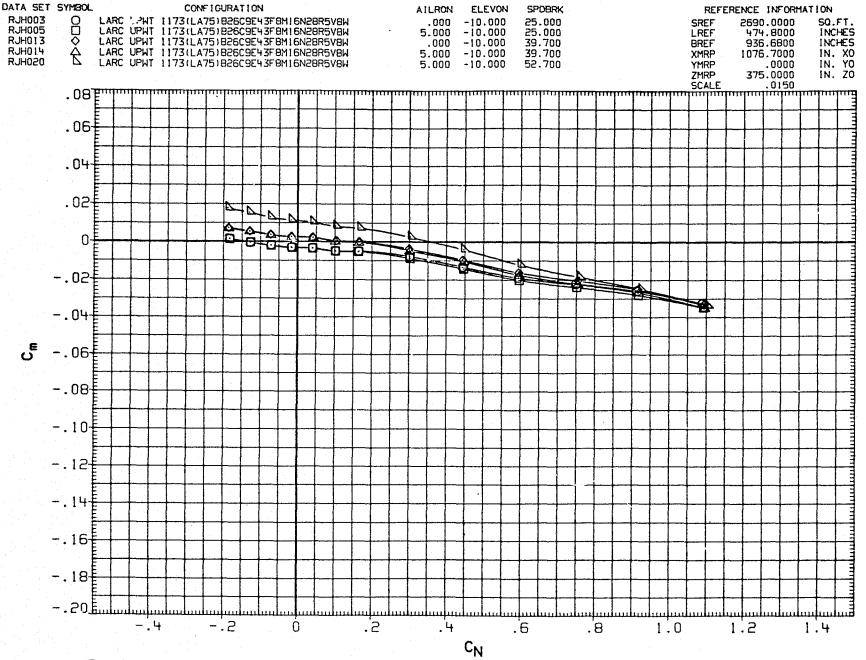


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

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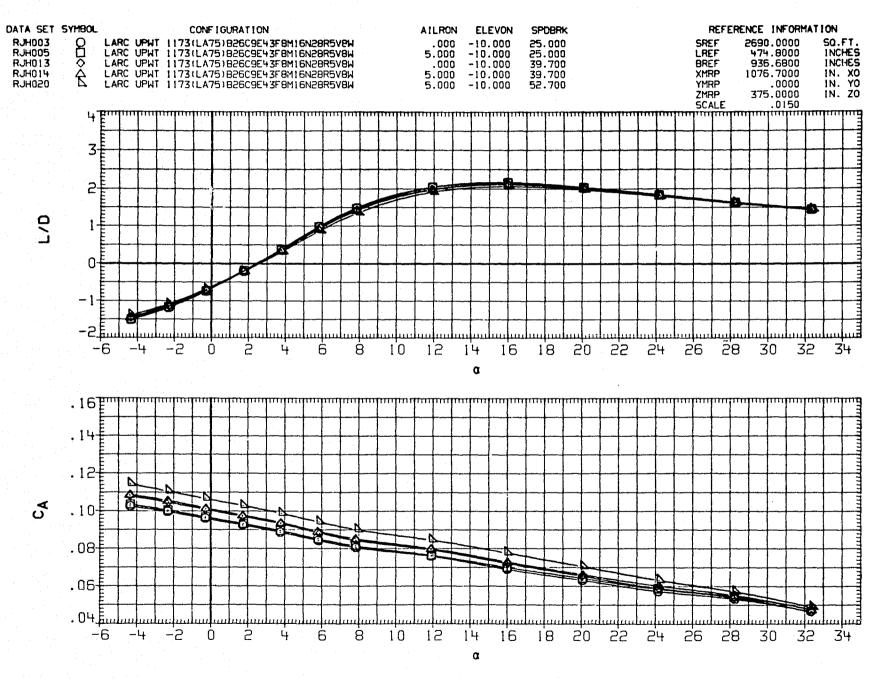


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

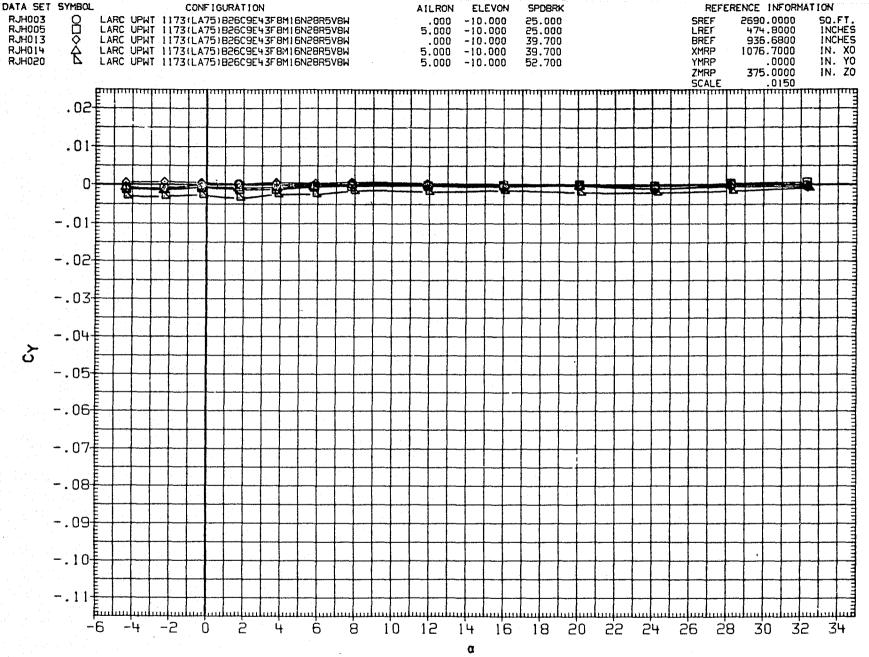


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON
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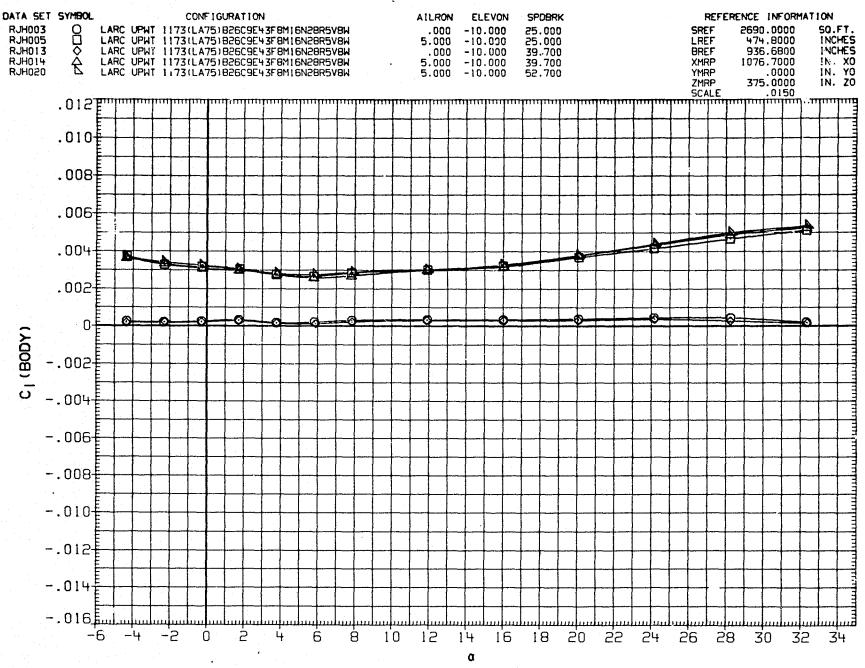


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON

(A) MACH = 2.86

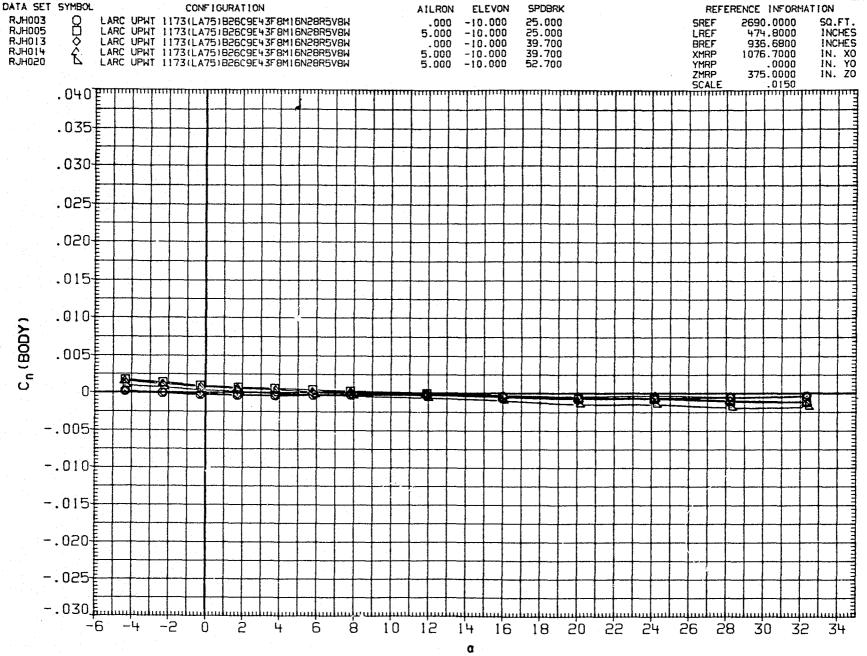


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

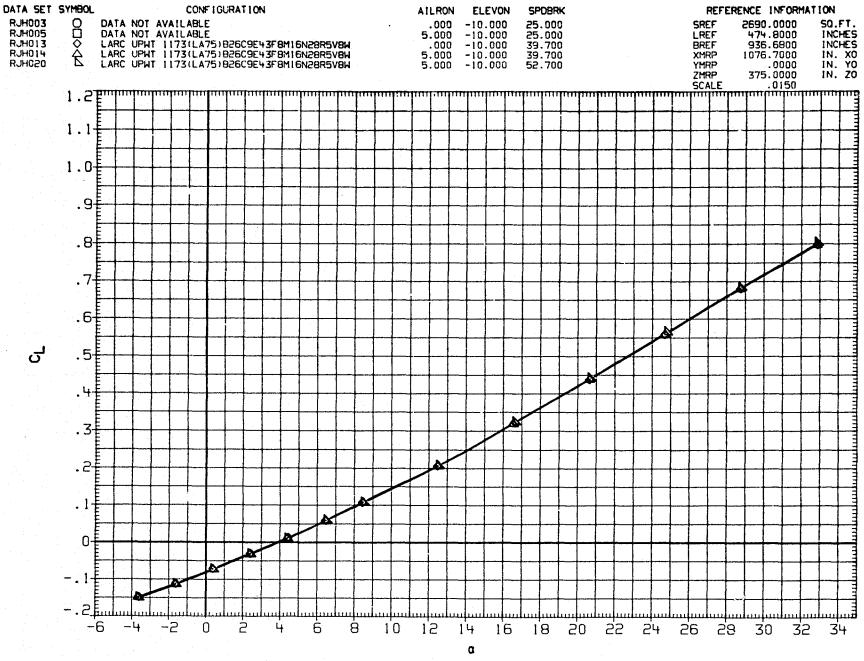


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

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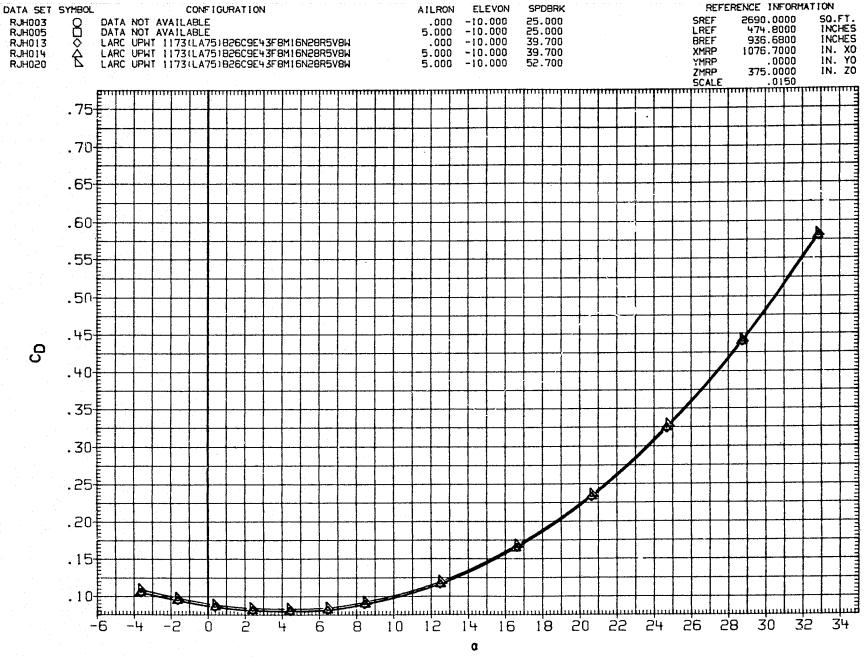


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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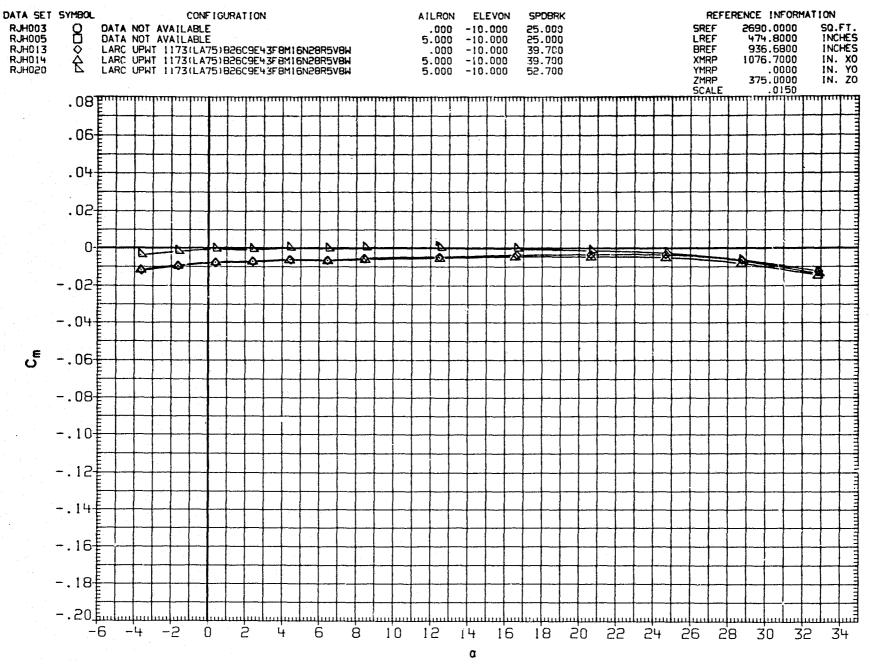


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

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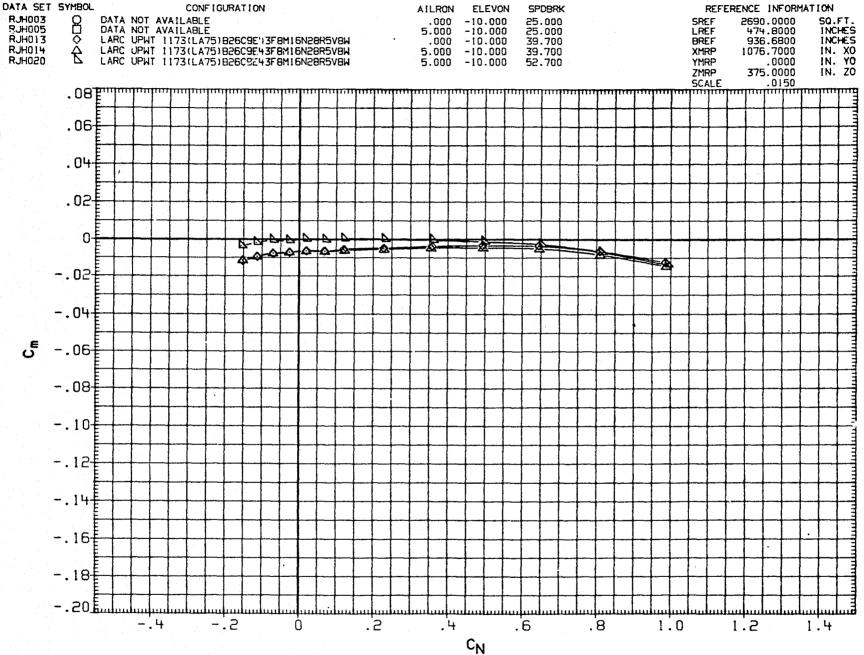


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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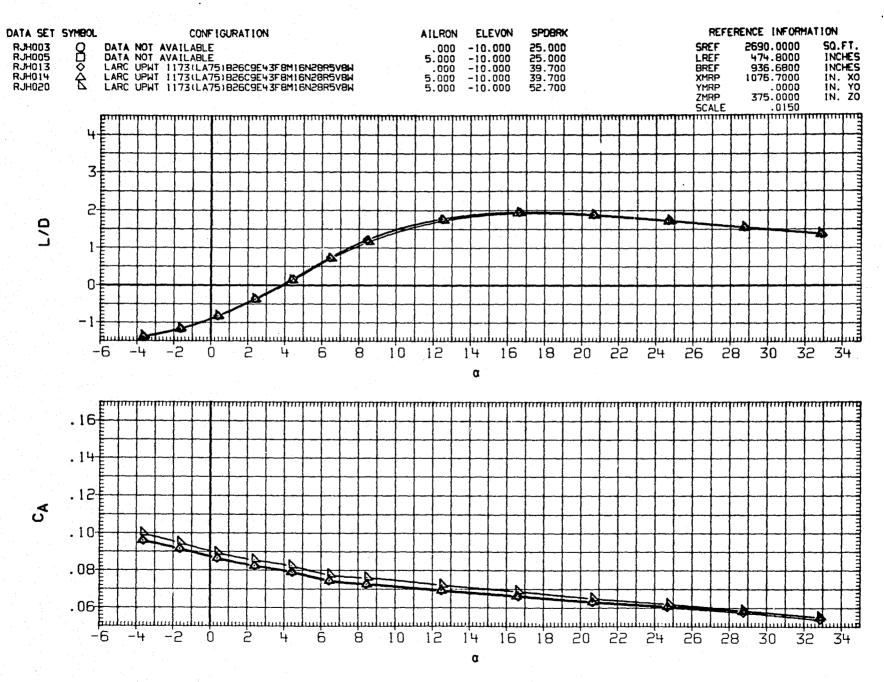


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B) MACH

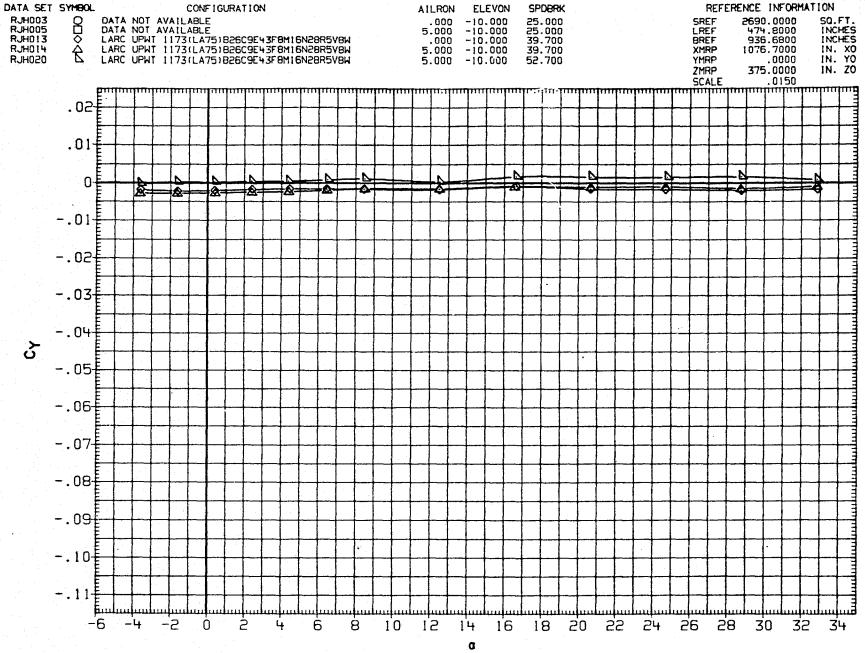


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

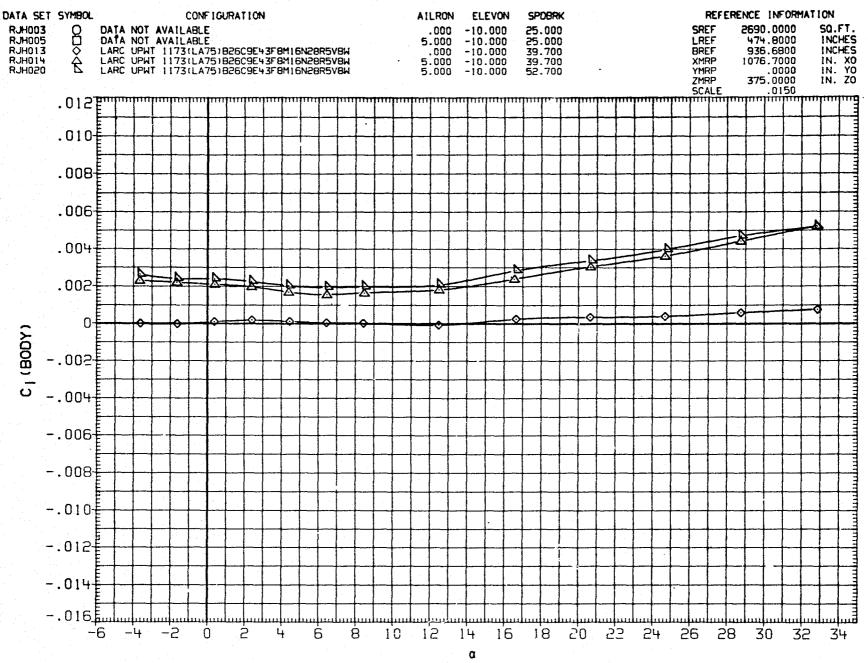


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

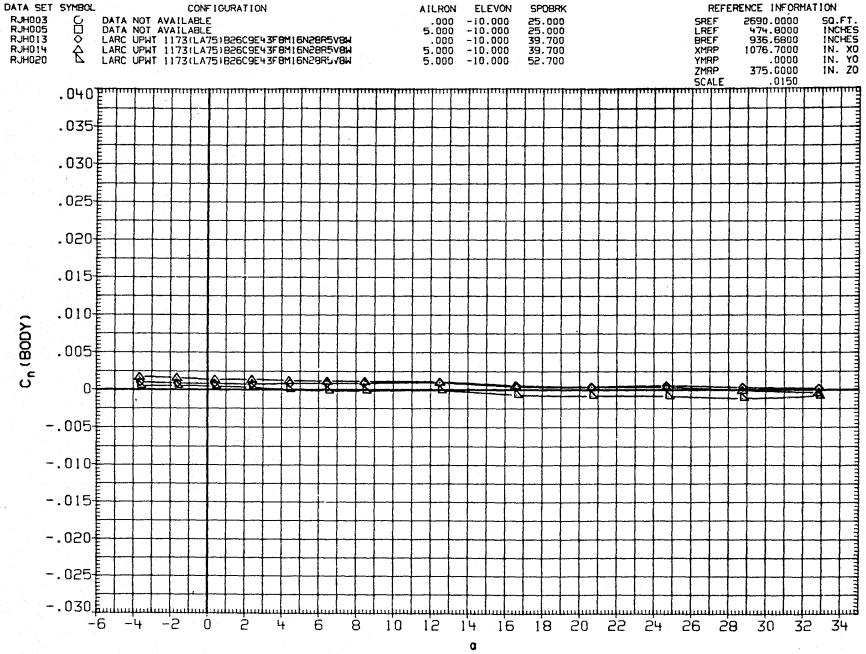


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

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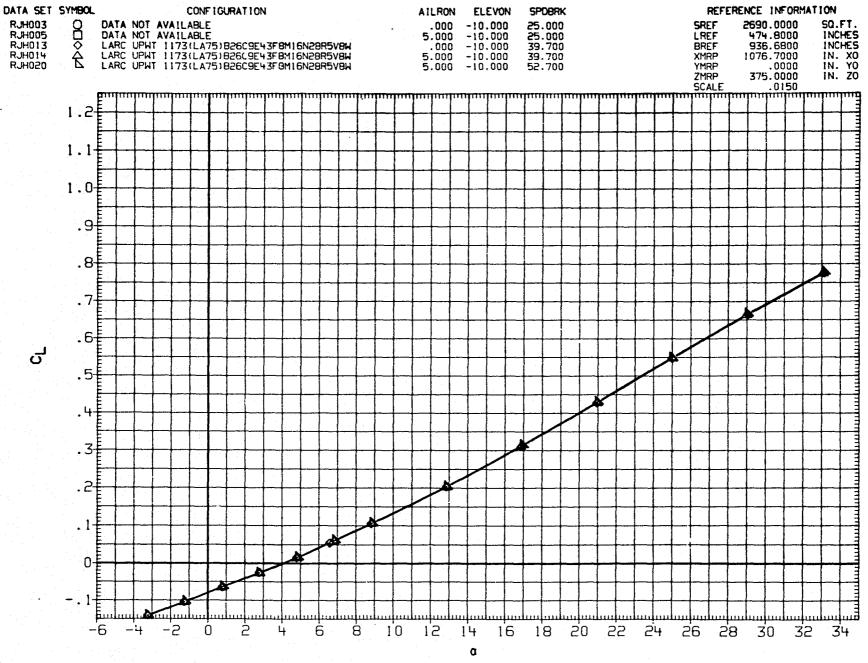


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

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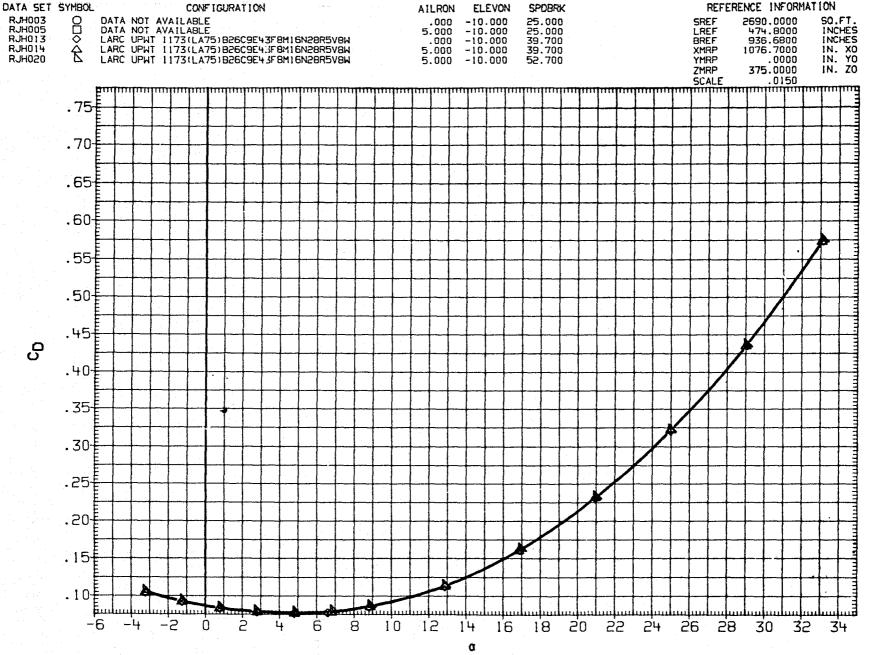


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

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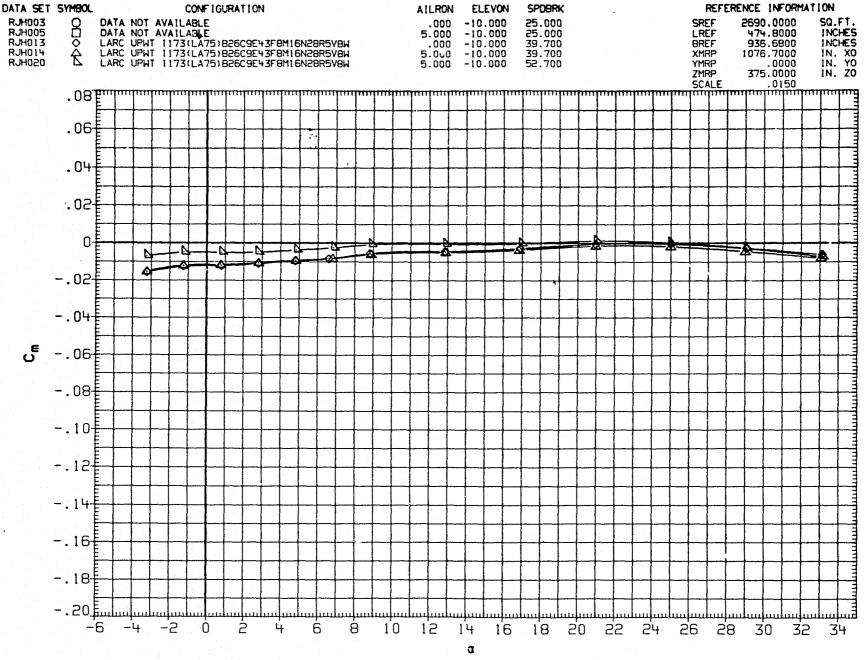


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

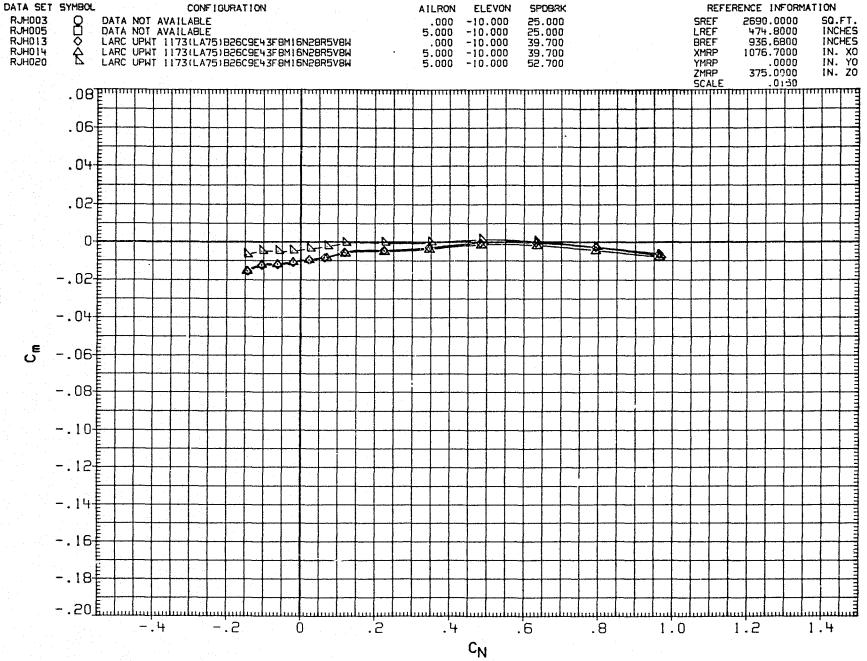


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

PAGE 362

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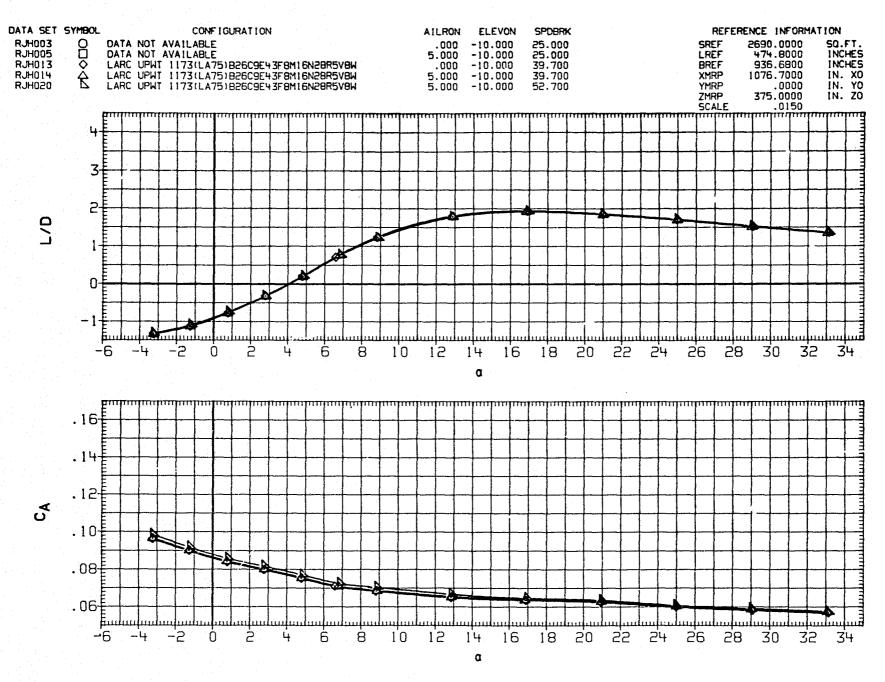


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(C) MACH = 4.60

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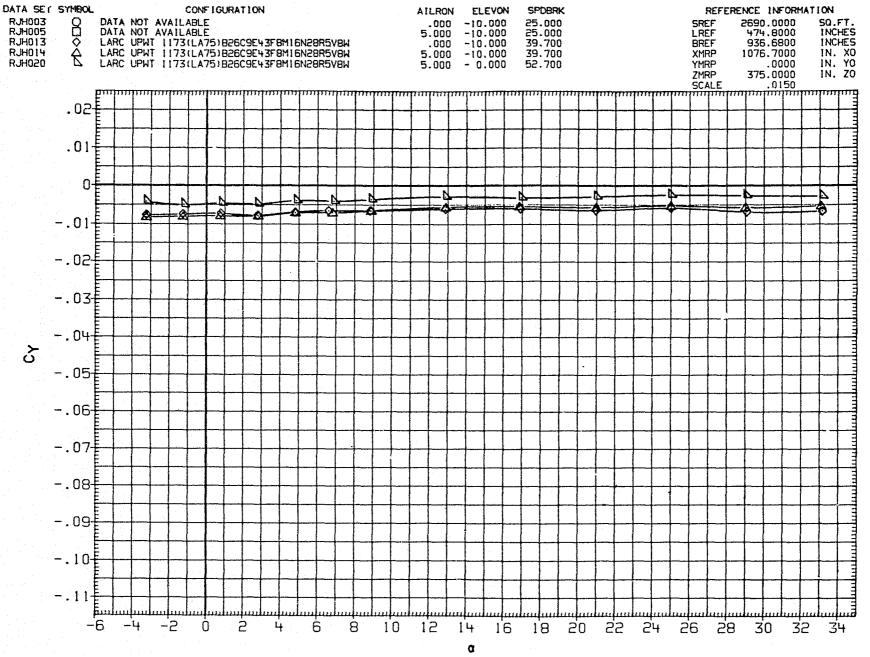


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(C)MACH = 4.60

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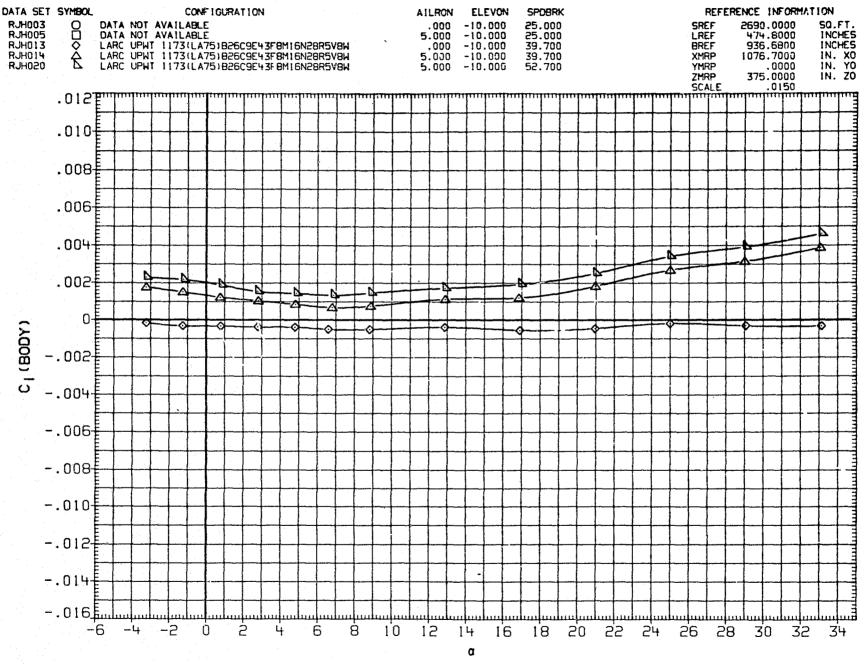


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

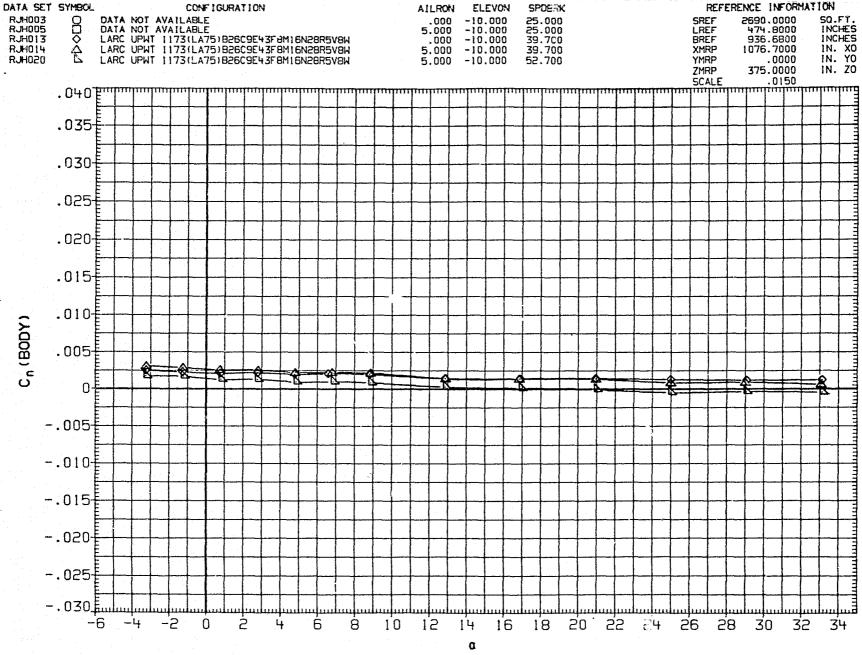


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(C) MACH = 4.60

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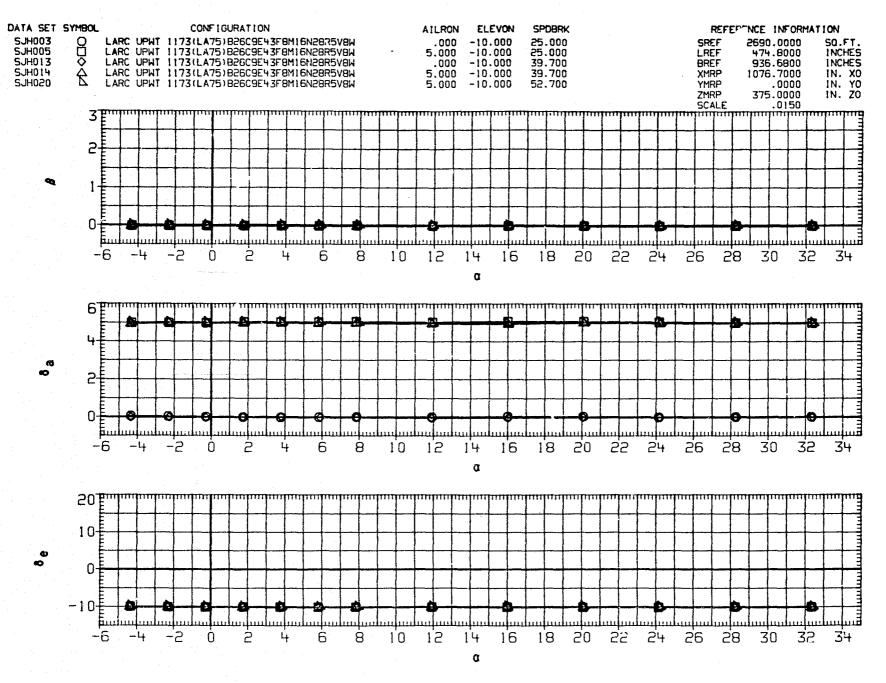


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

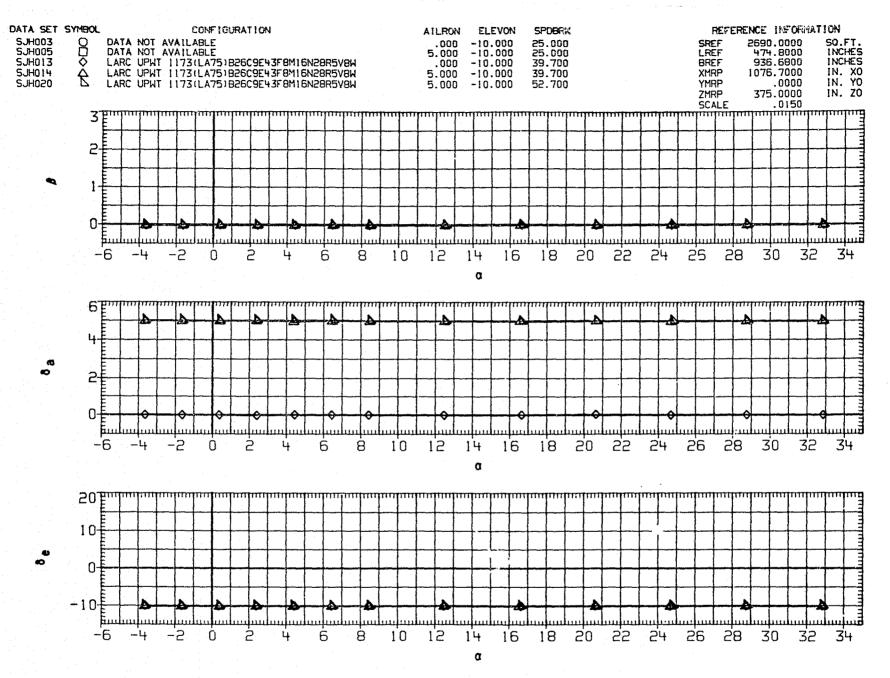


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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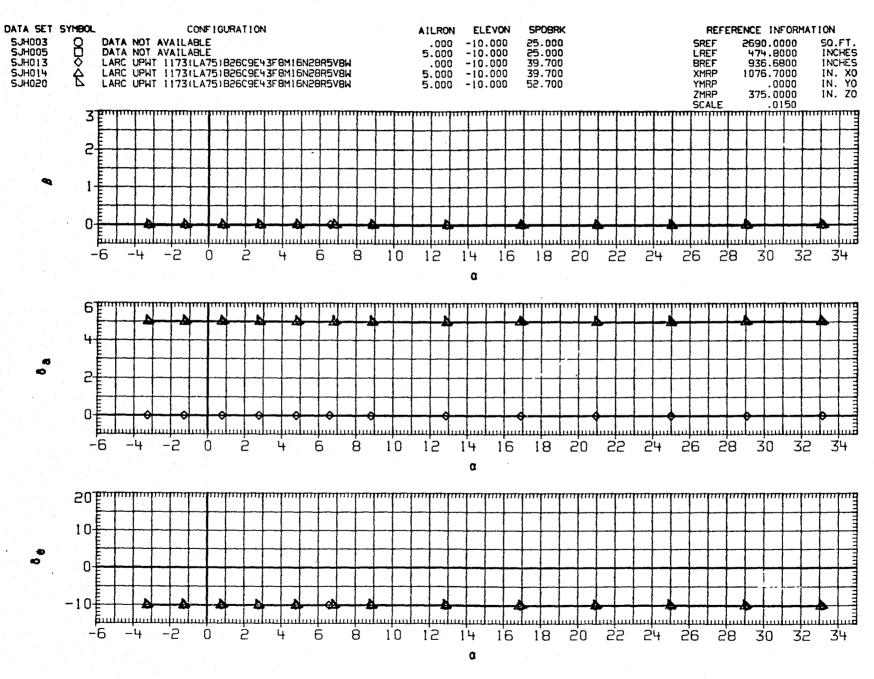


FIGURE 12(A). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

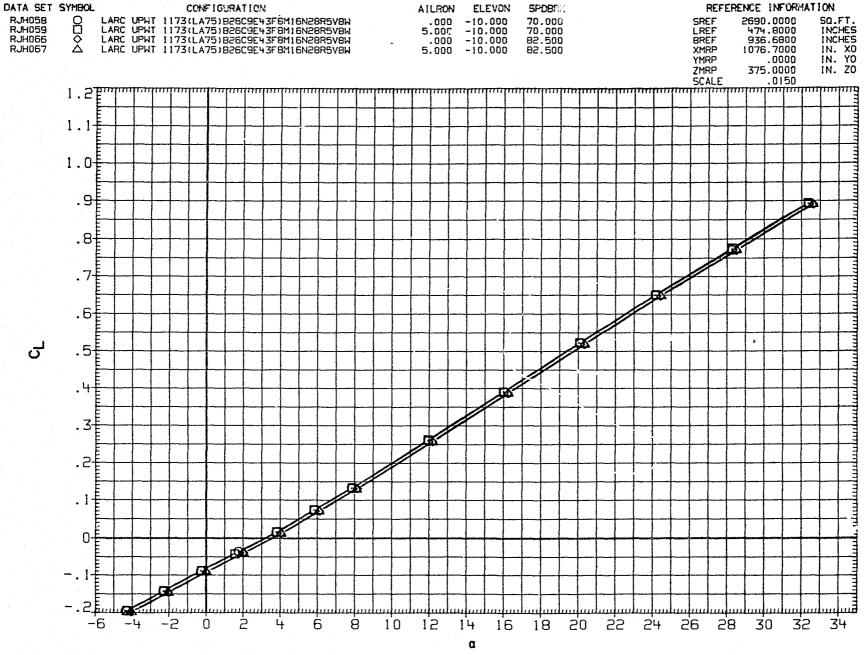


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON

(A) MACH = 2.86

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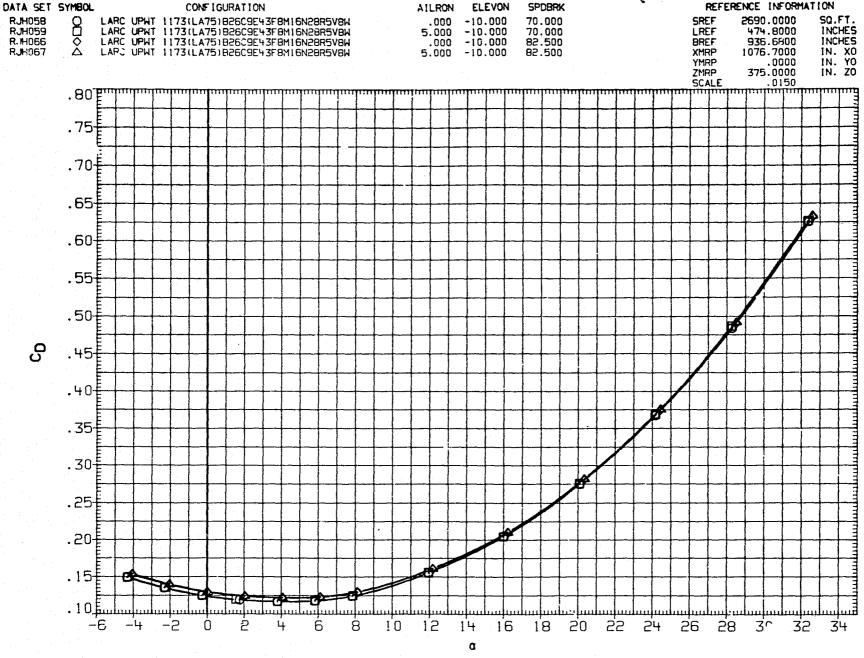


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

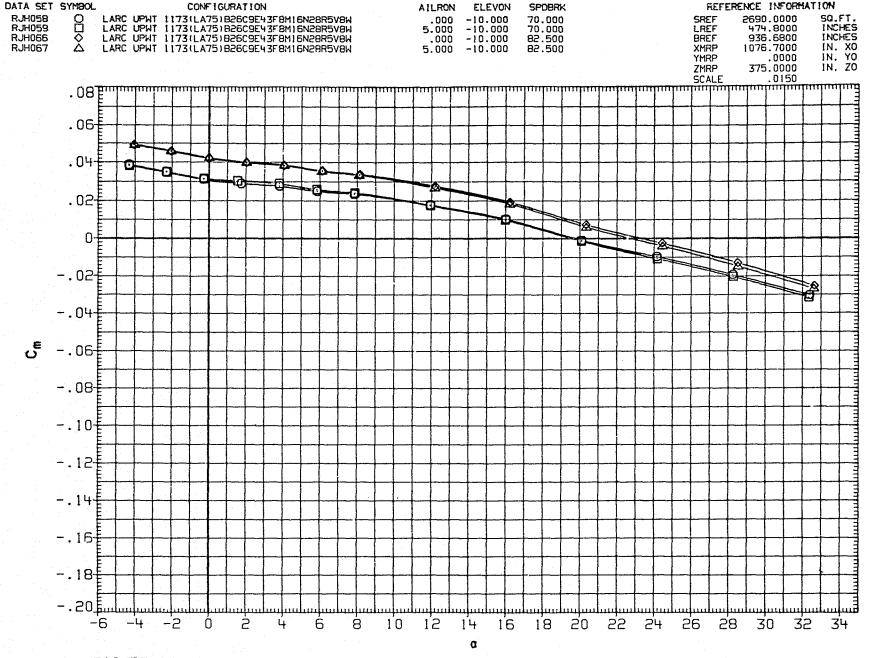


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON

(A) MACH = 2.86

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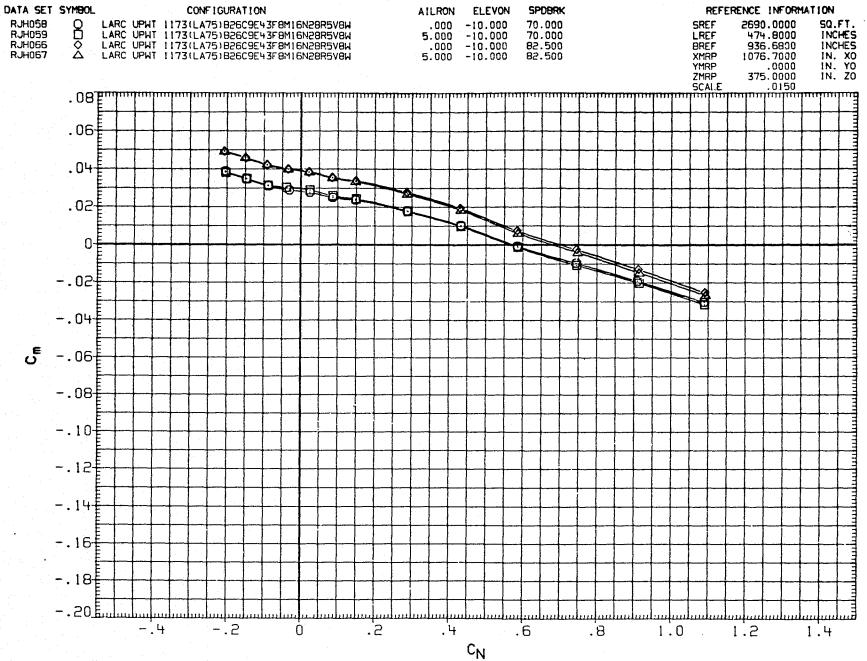


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

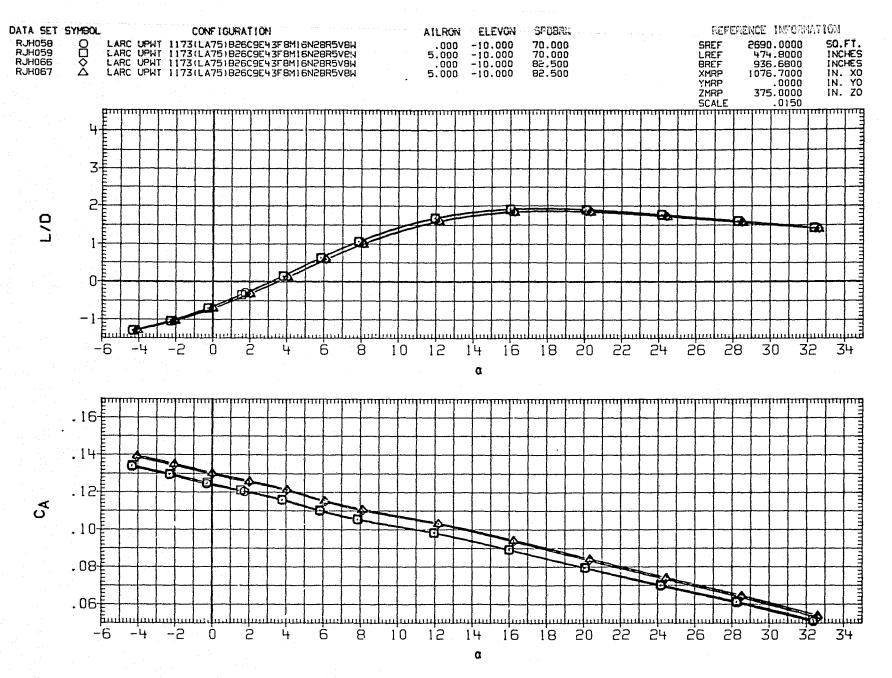


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

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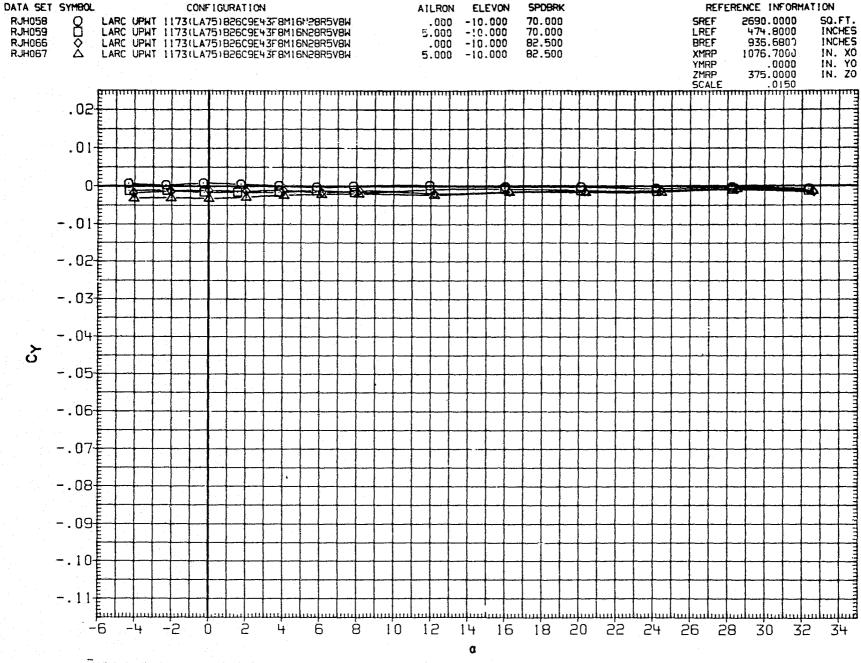


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

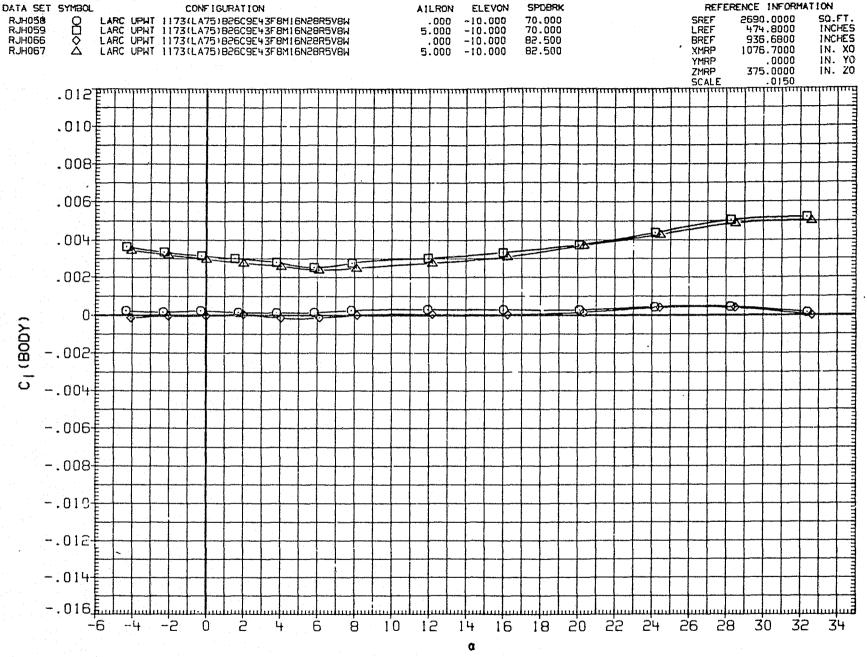


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

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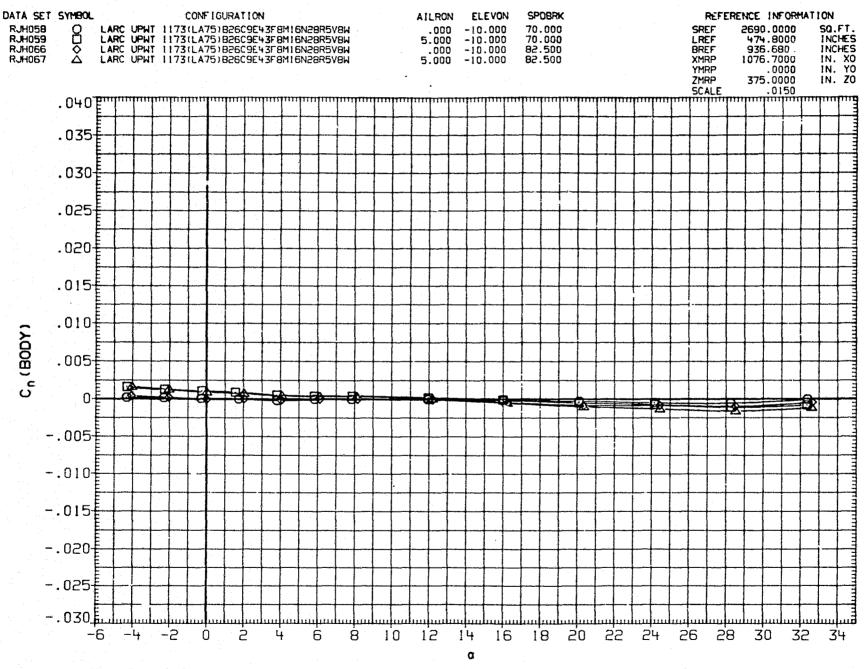
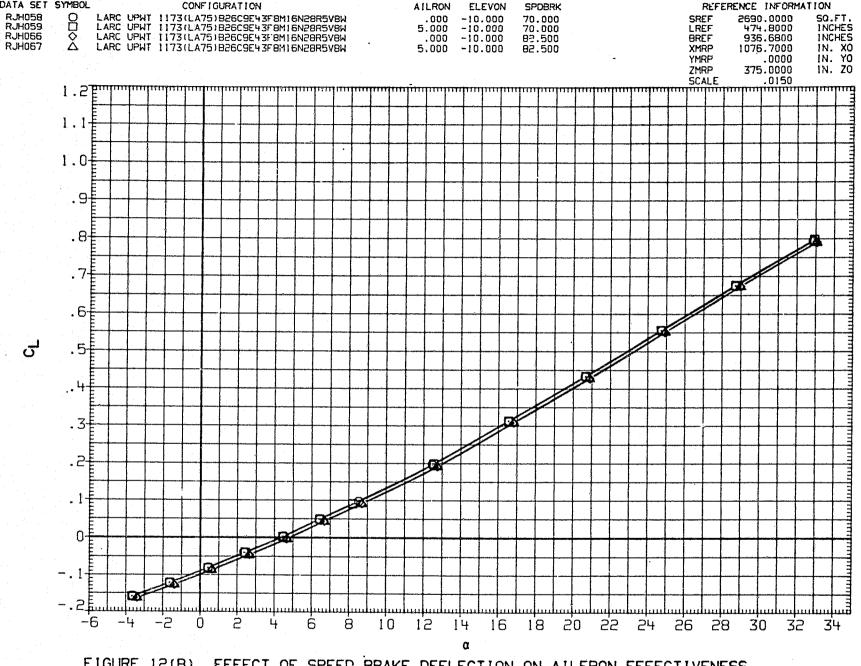


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON = 2.85

(A) MACH



DATA SET SYMBOL

CONFIGURATION

FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON (B)MACH =3.90 PAGE

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REFERENCE INFORMATION

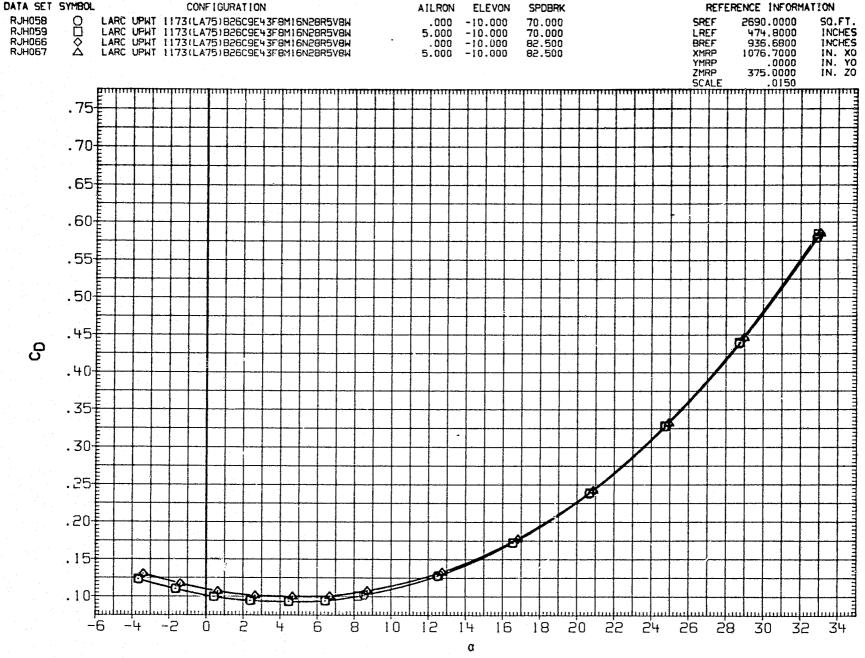


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

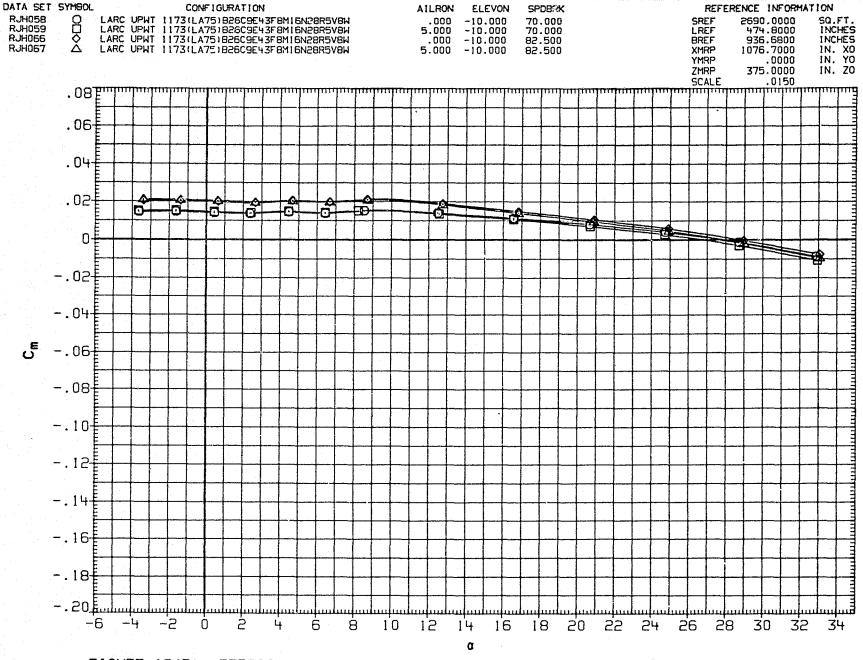


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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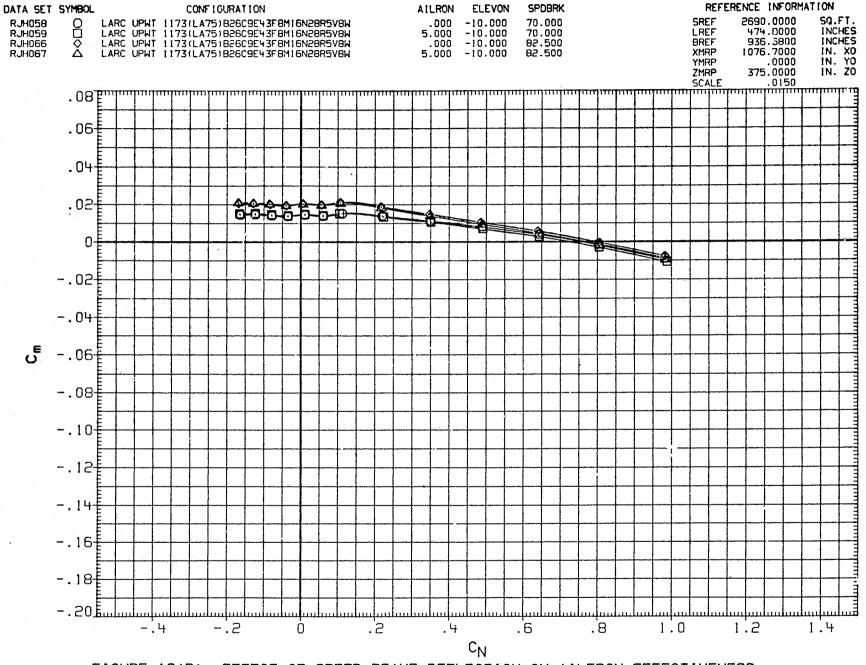


FIGURE 12(B) EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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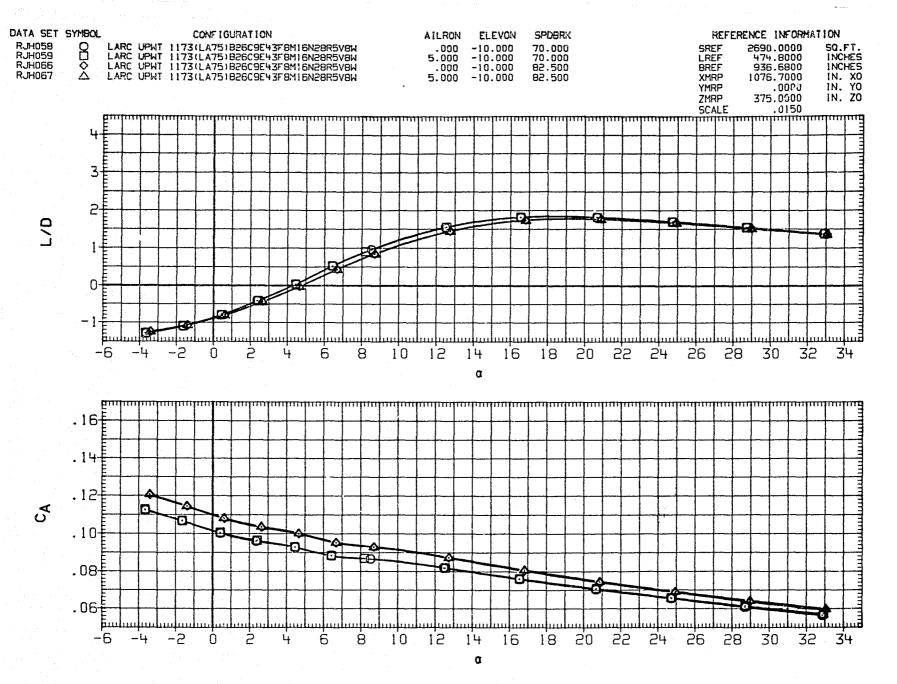


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS
AT -10 DEG. TRIM ELEVON

(B) MACH = 3.90

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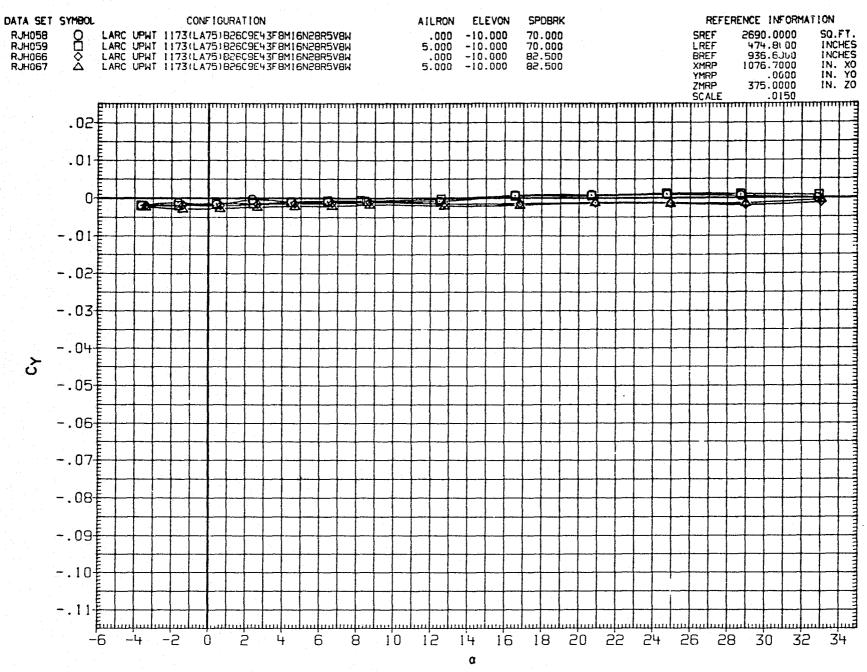


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

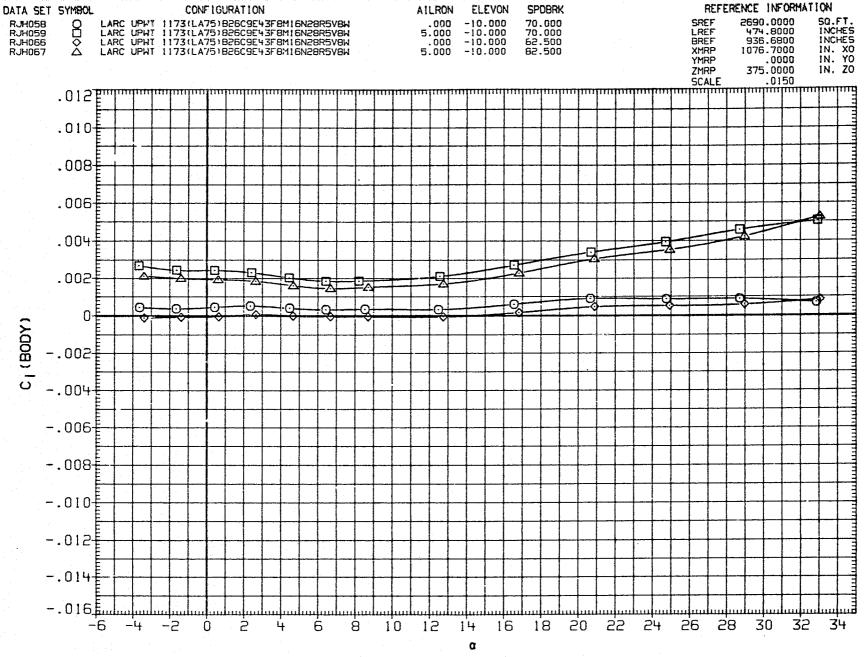


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

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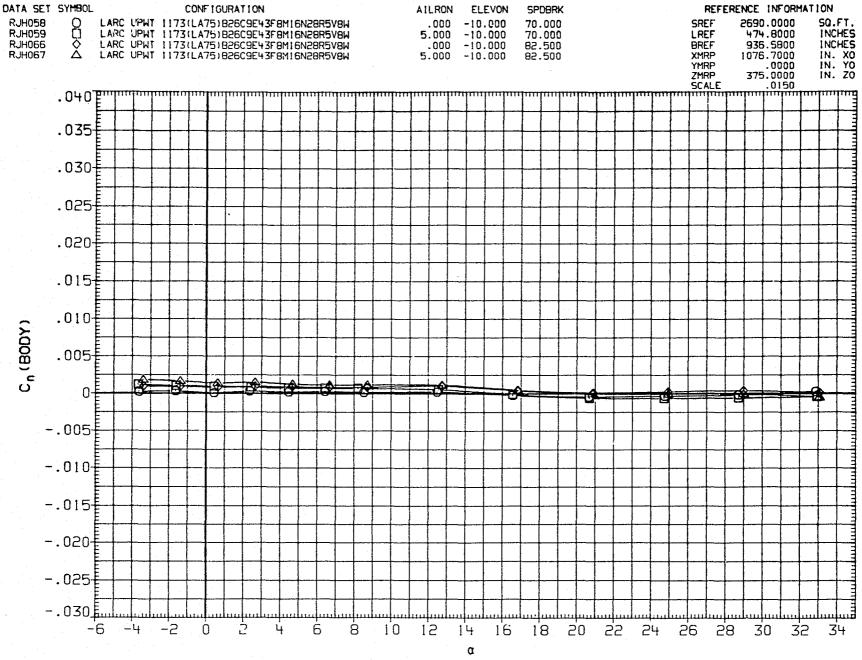


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(B)MACH = 3.90

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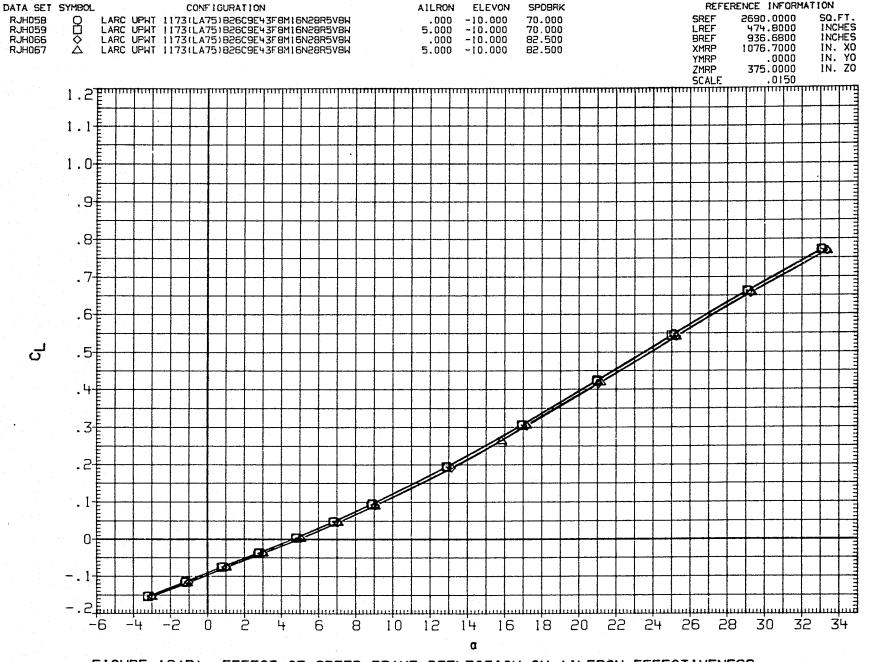


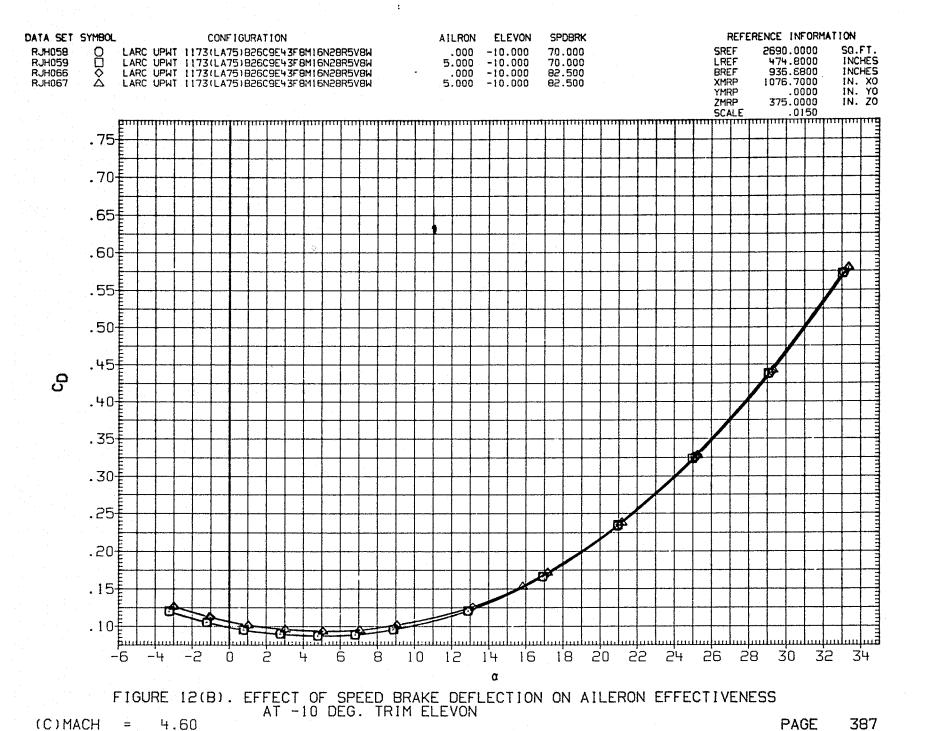
FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

(C)MACH = 4.60

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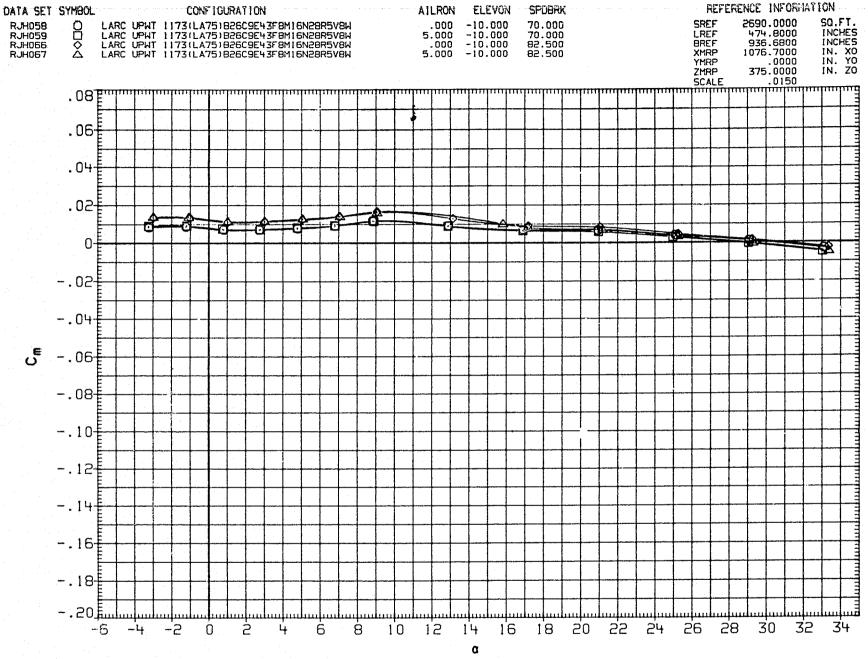


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

PAGE

(C)MACH

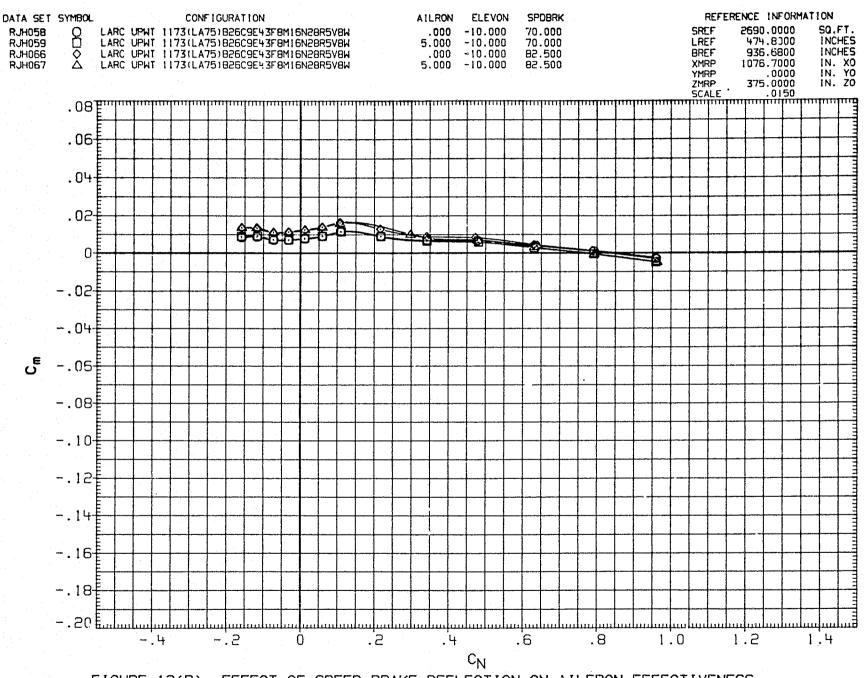


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

(C)MACH = 4.60

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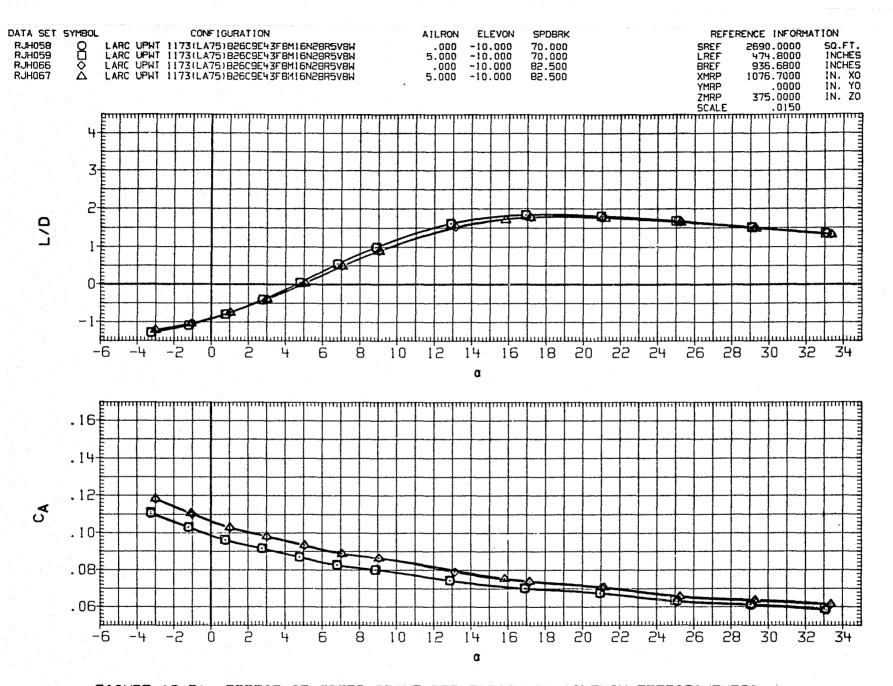


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

(C) MACH = 4.60

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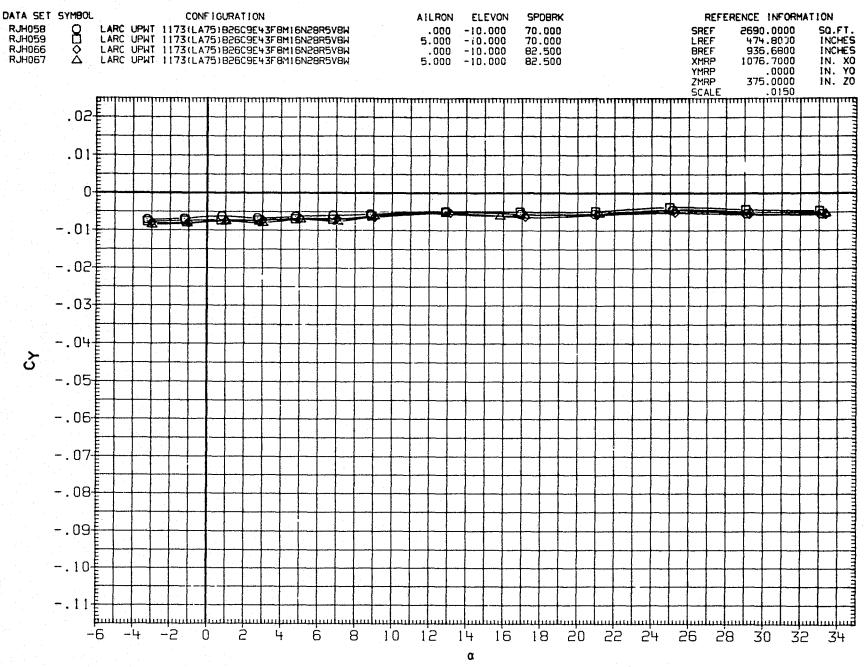


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

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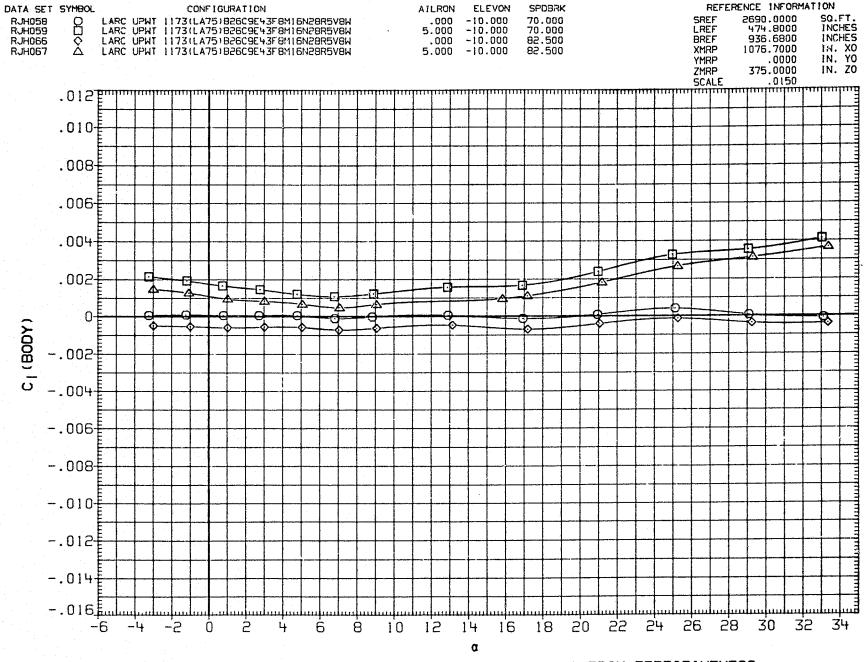


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS

AT -10 DEG. TRIM ELEVON

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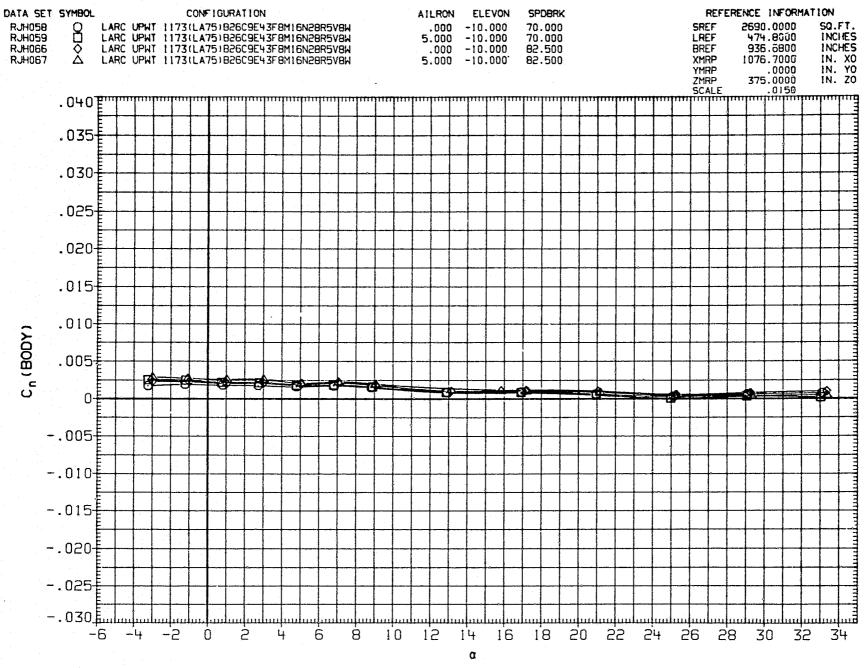


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(C)MACH = 4.60

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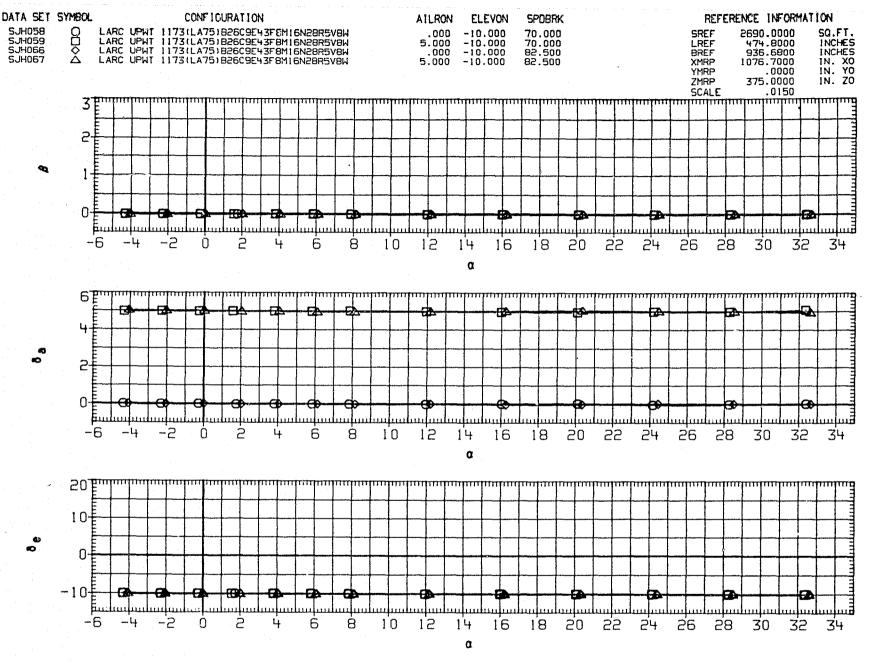


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(A)MACH = 2.86

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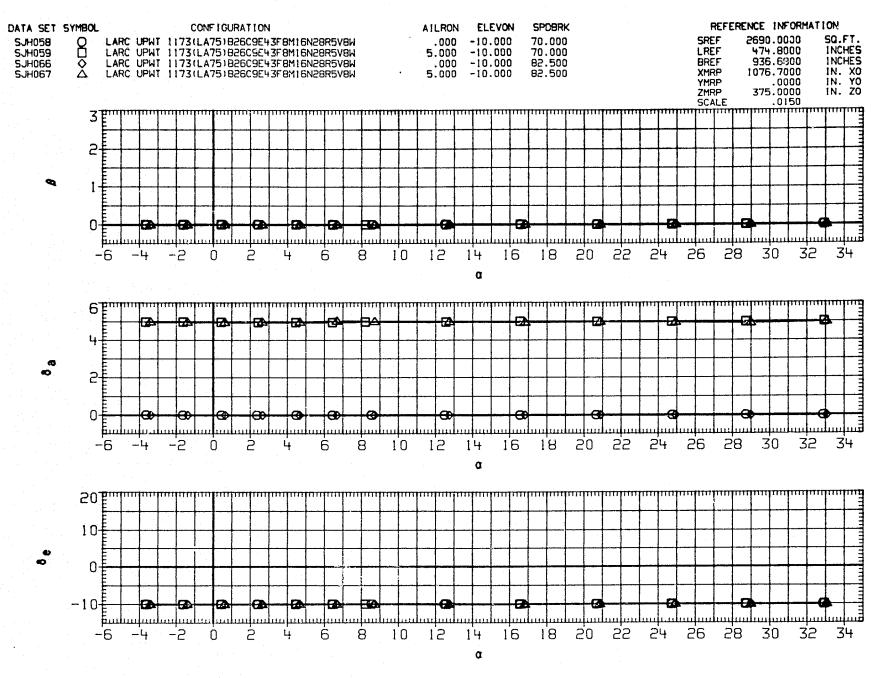


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON = 3.90

(B) MACH

PAGE

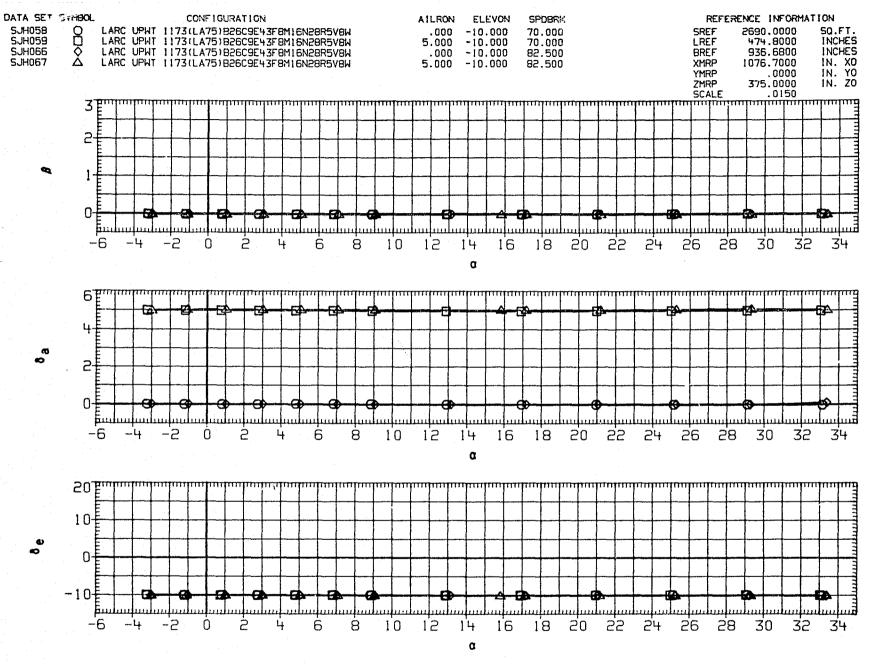


FIGURE 12(B). EFFECT OF SPEED BRAKE DEFLECTION ON AILERON EFFECTIVENESS AT -10 DEG. TRIM ELEVON

(C)MACH = 4.60

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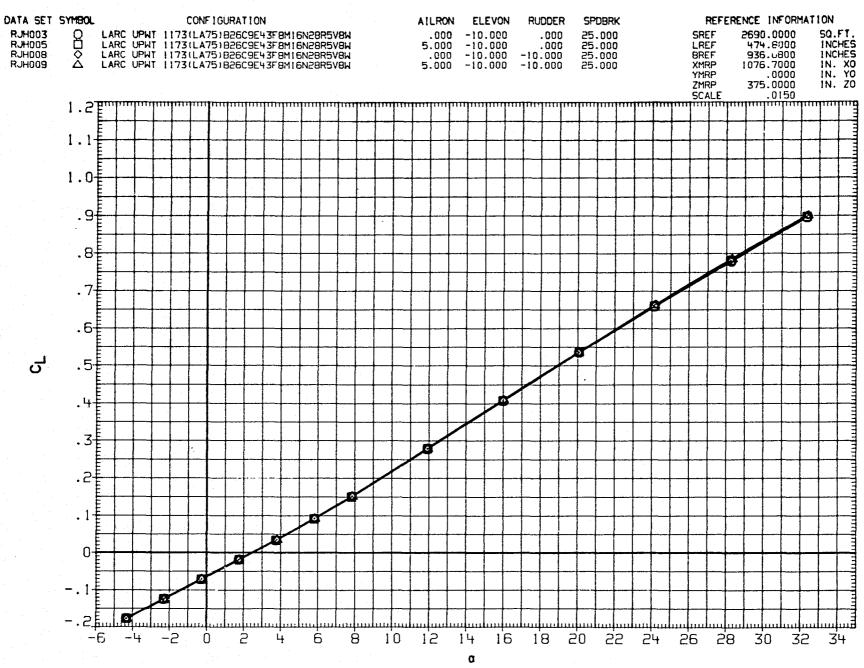


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A)MACH = 2.86

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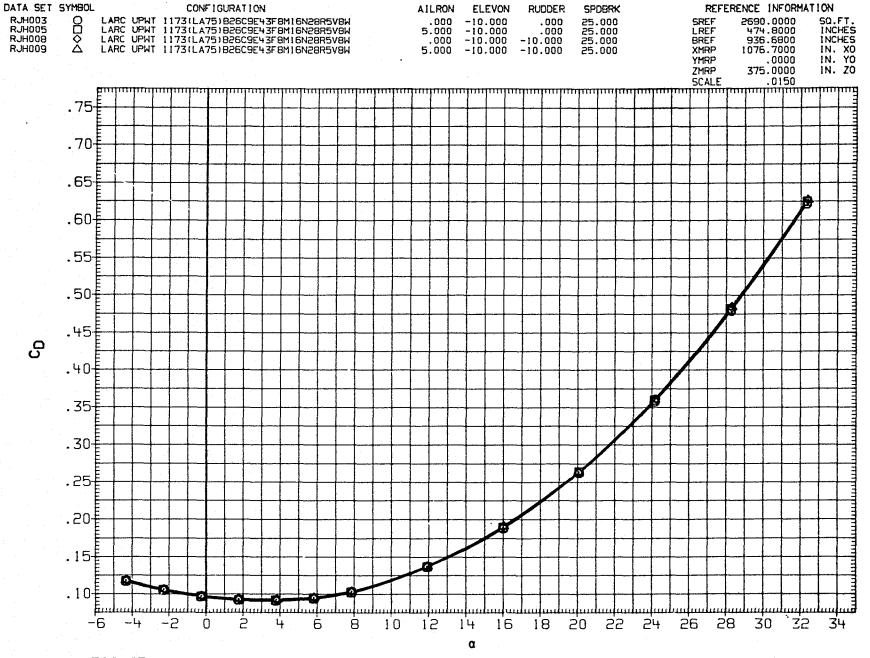


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

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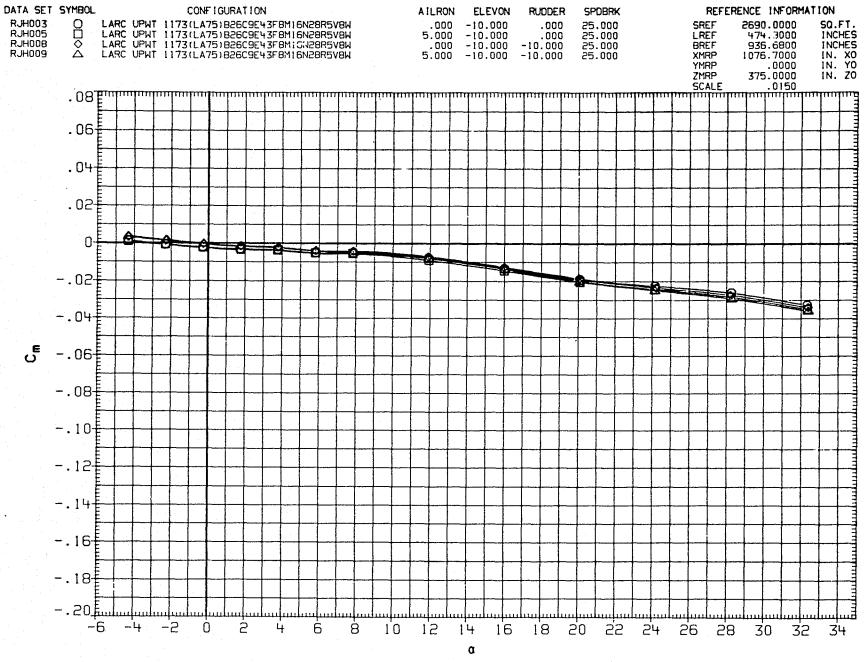


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

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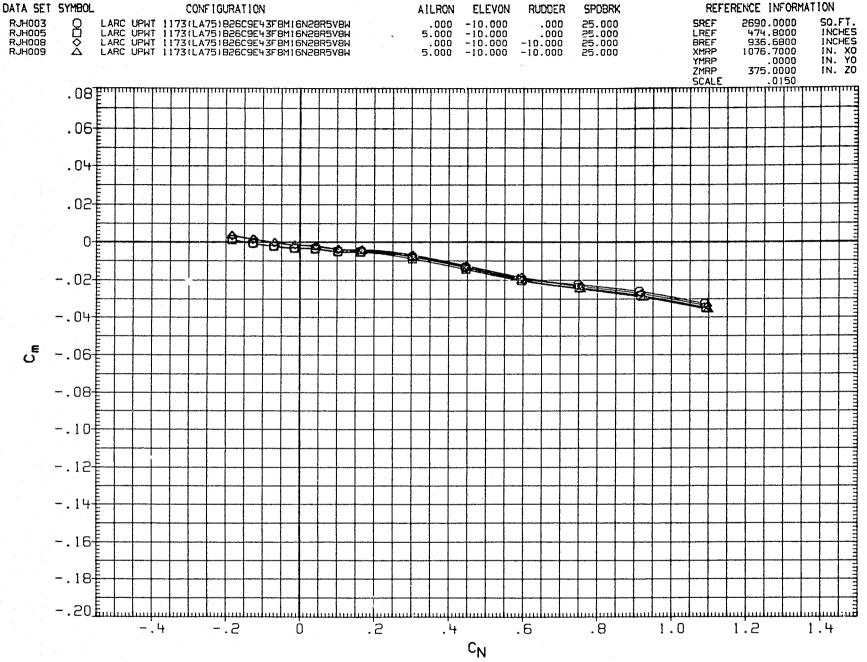


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

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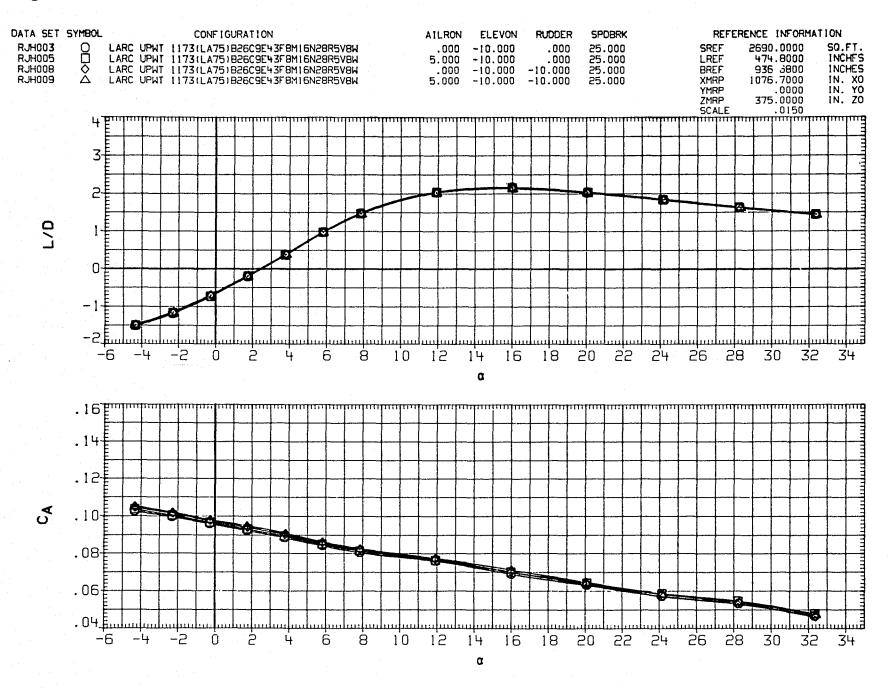


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEYON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

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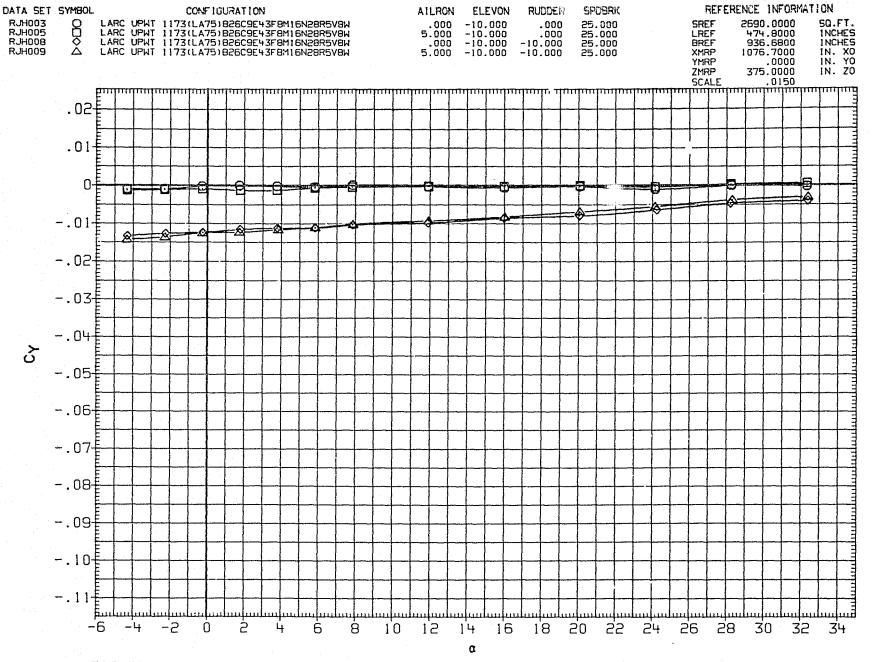


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86
PAGE 402

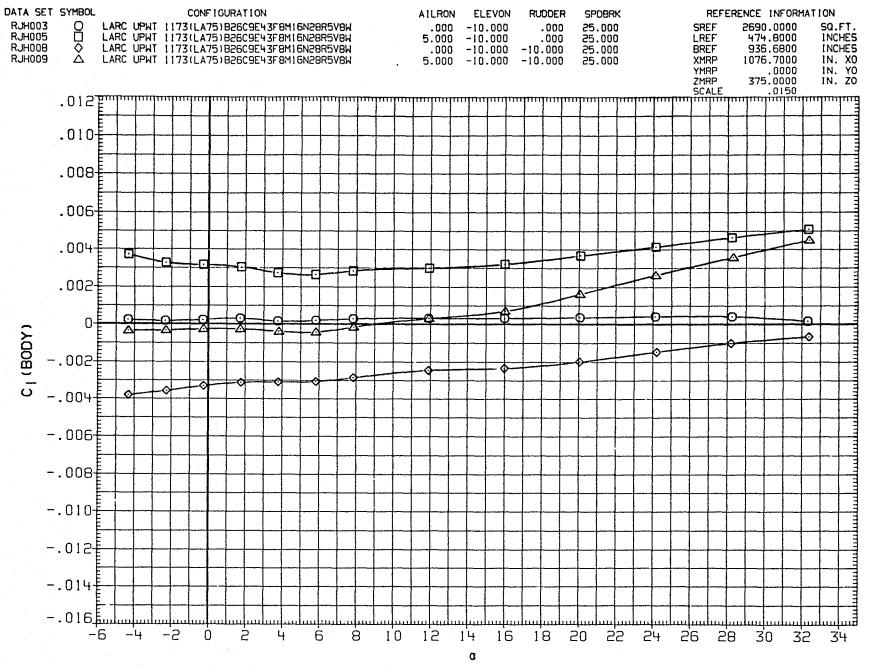


FIGURE 13(A). CONTROL SURFACE 'NTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86
PAGE 403

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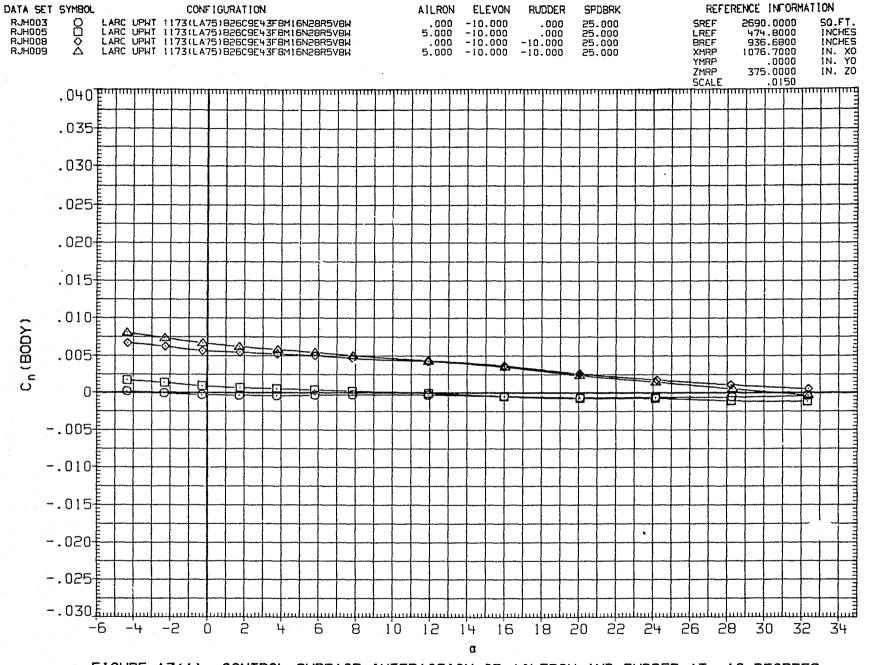


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86

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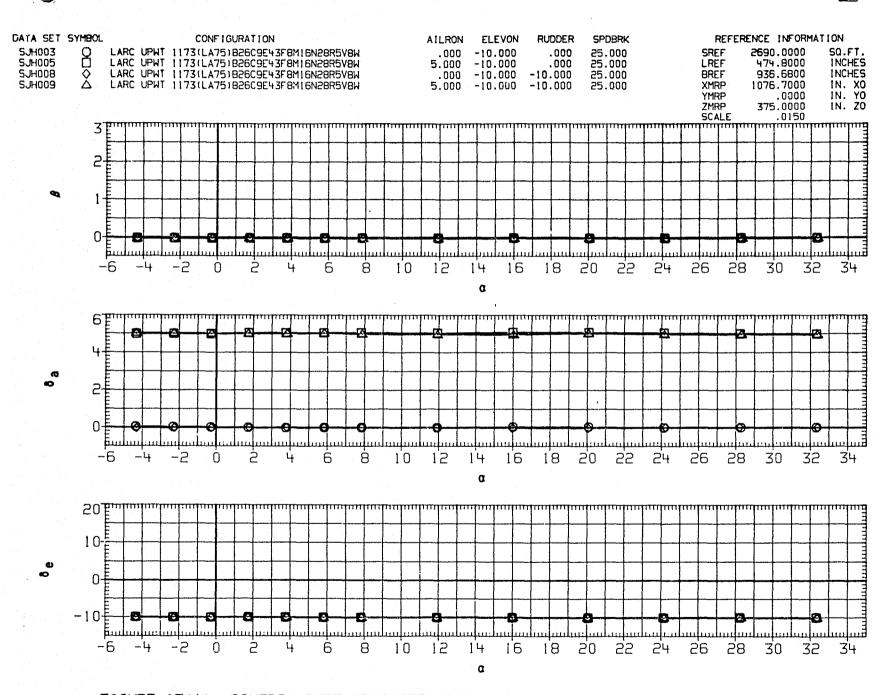


FIGURE 13(A). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 25 DEG.

(A) MACH = 2.86
PAGE 405

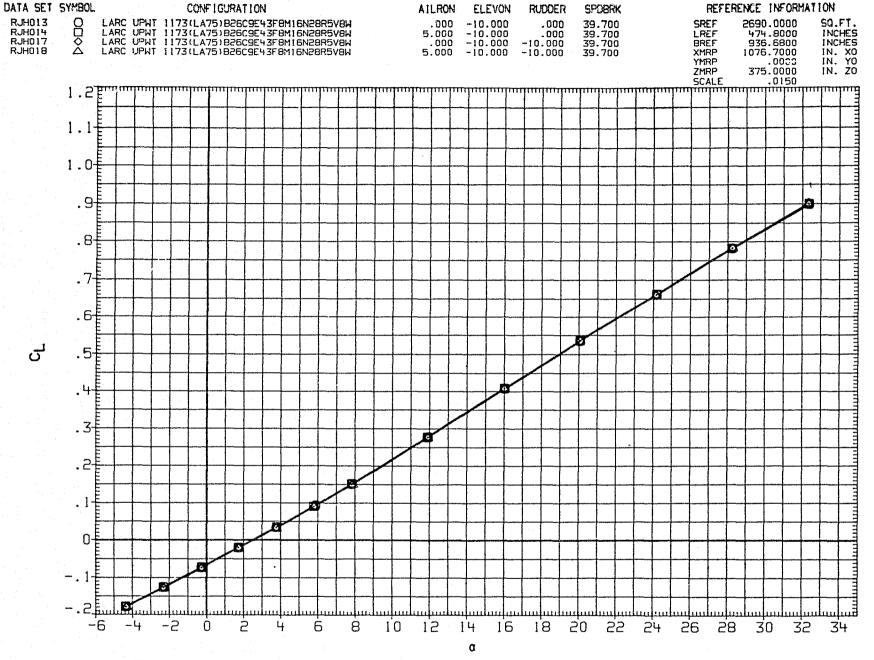


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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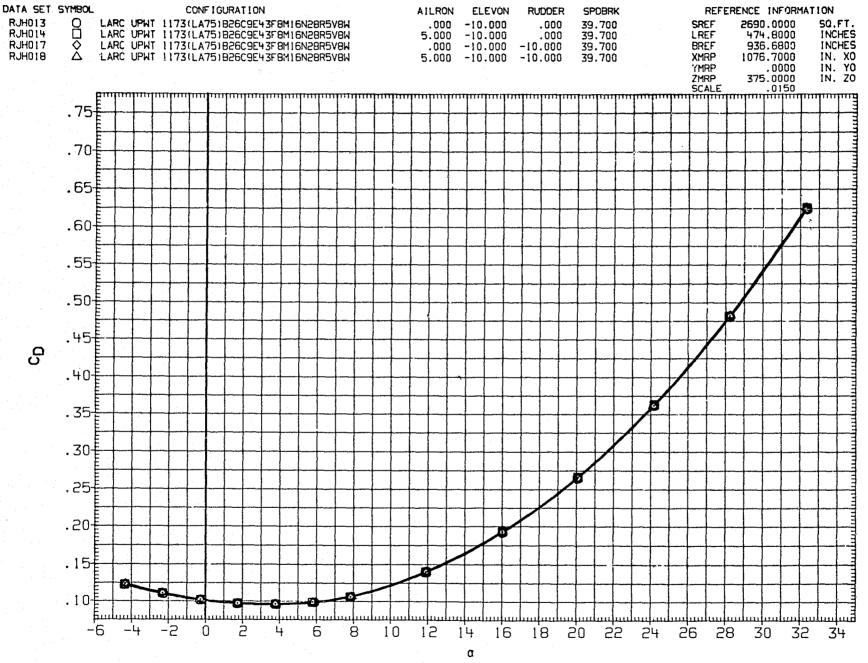


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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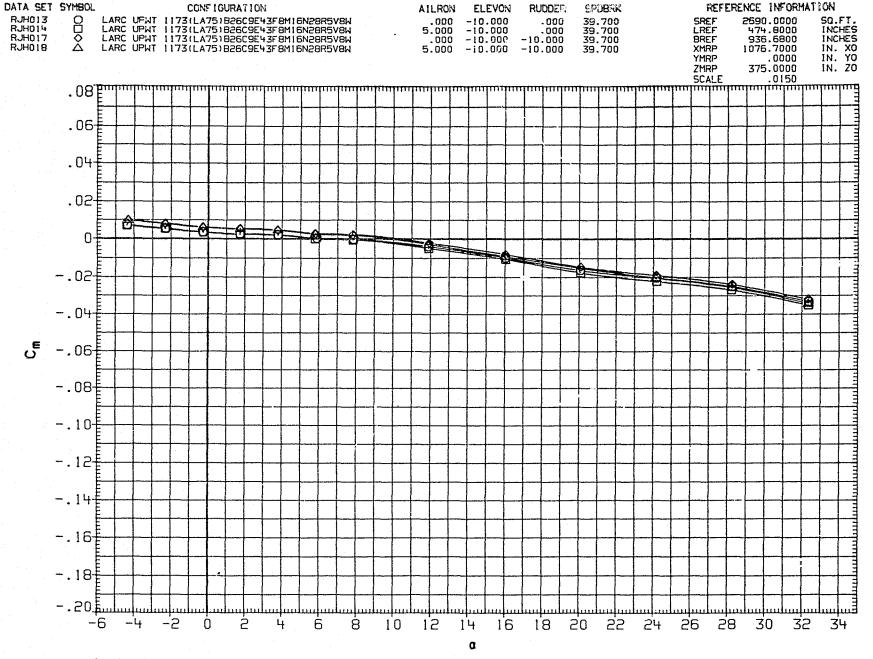
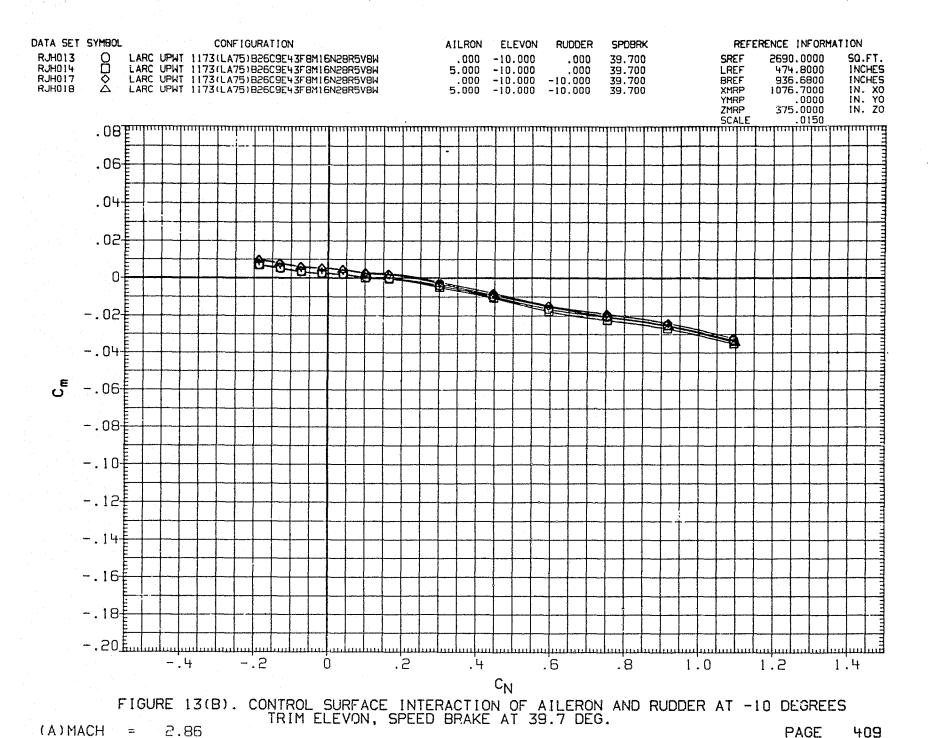


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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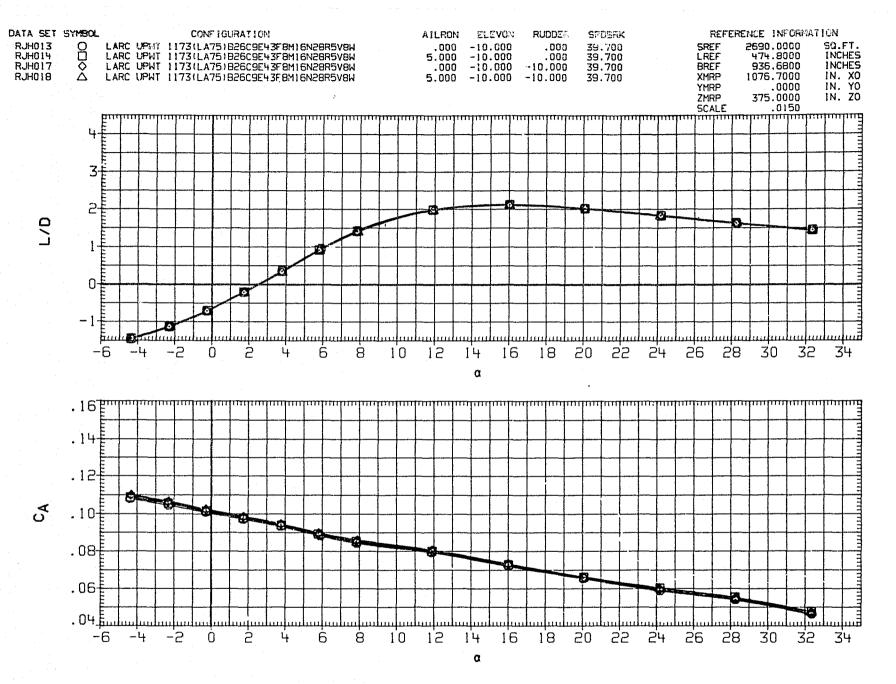


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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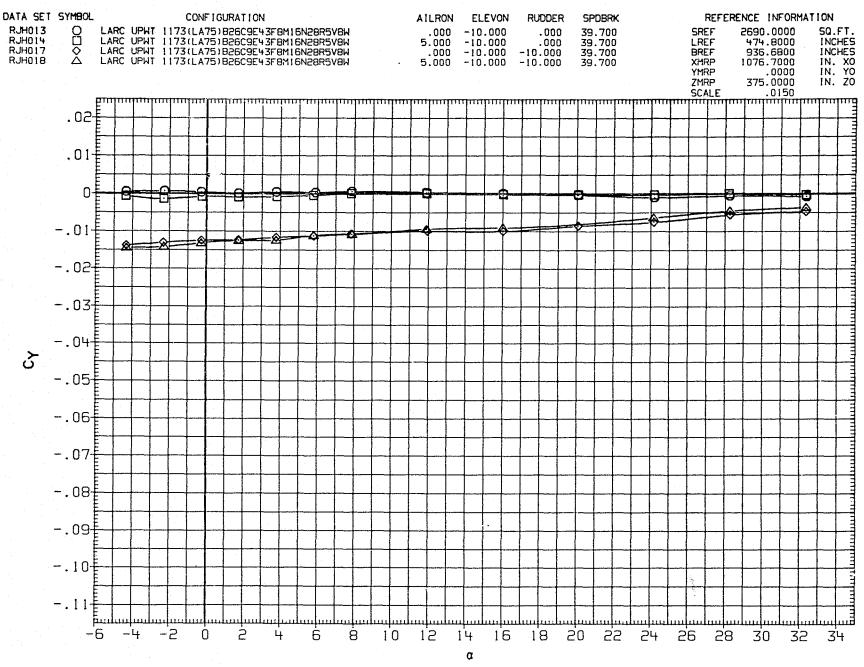


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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PAGE 411

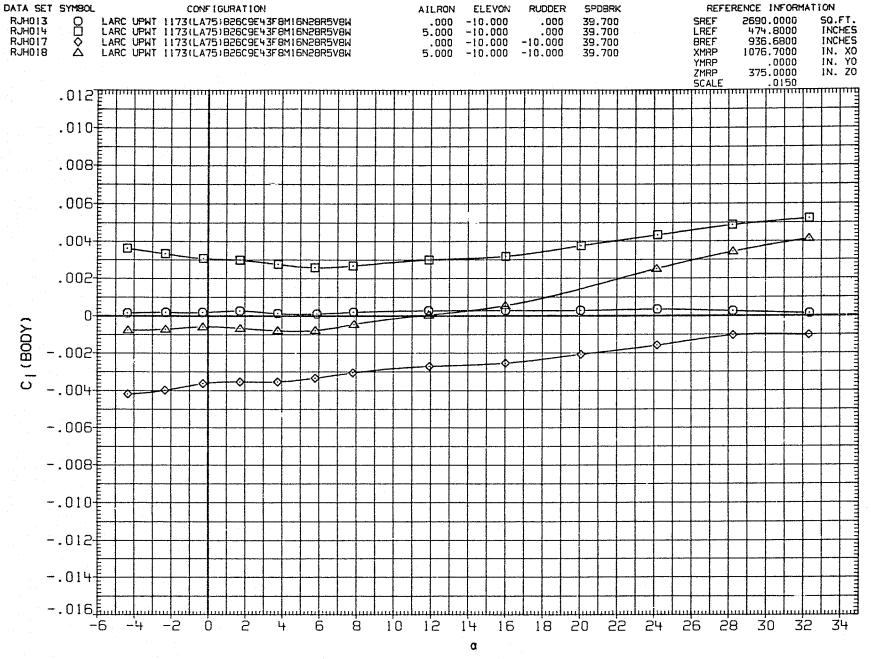


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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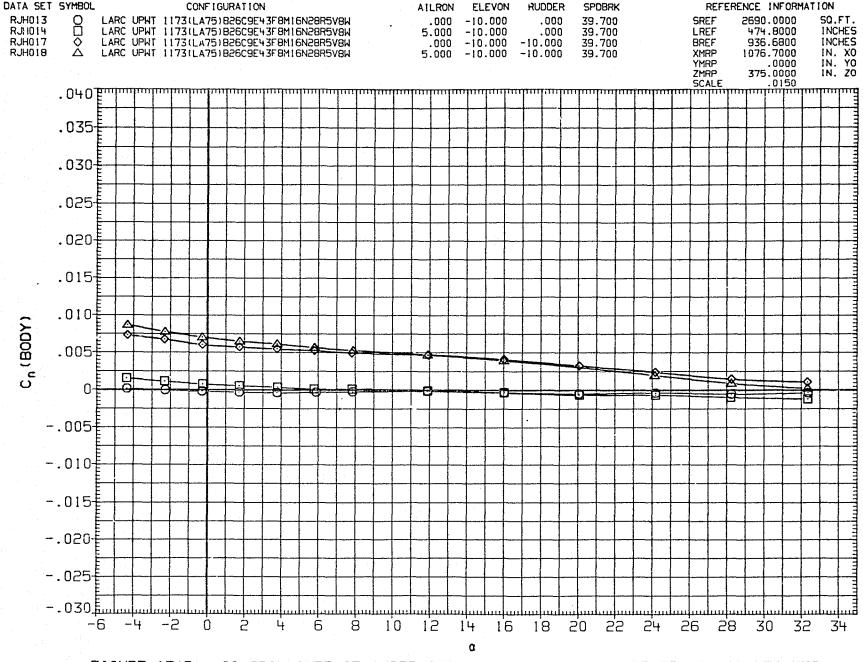
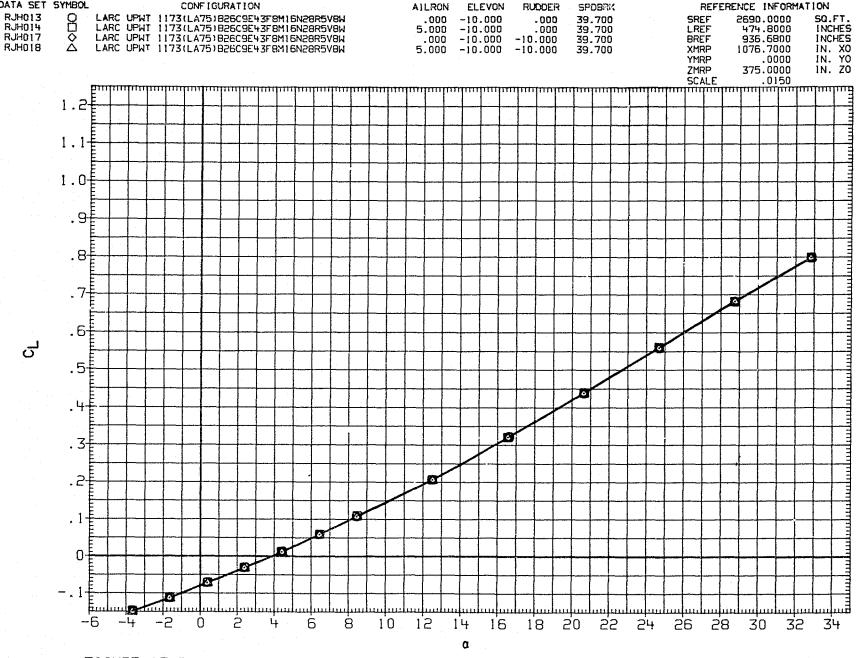


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A)MACH = 2.86
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ELEVON

- DATA SET SYMBOL

CONFIGURATION

FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 39.7 DEG. (B)MACH = 3.90PAGE 414

REFERENCE INFORMATION

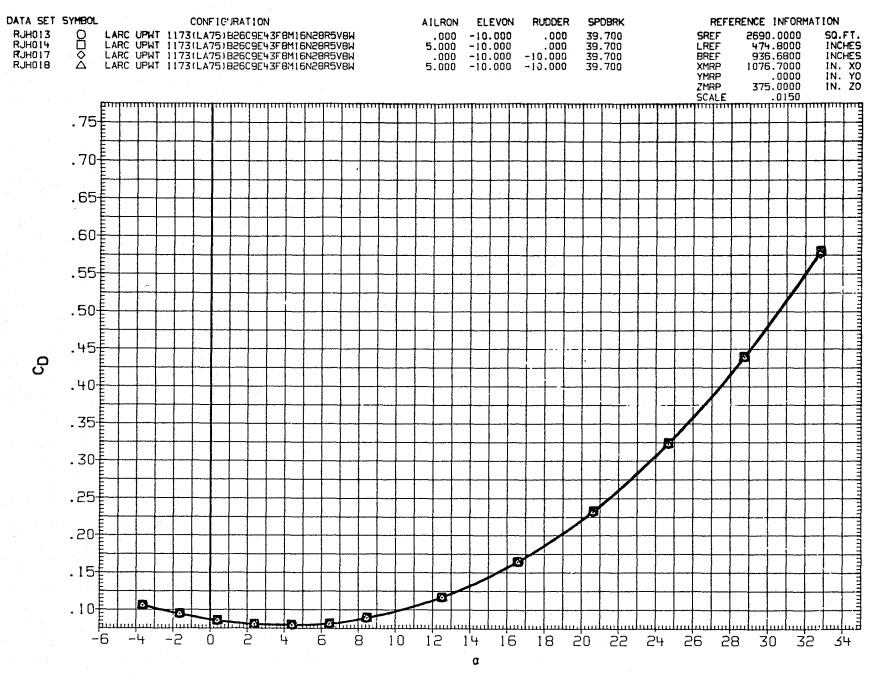


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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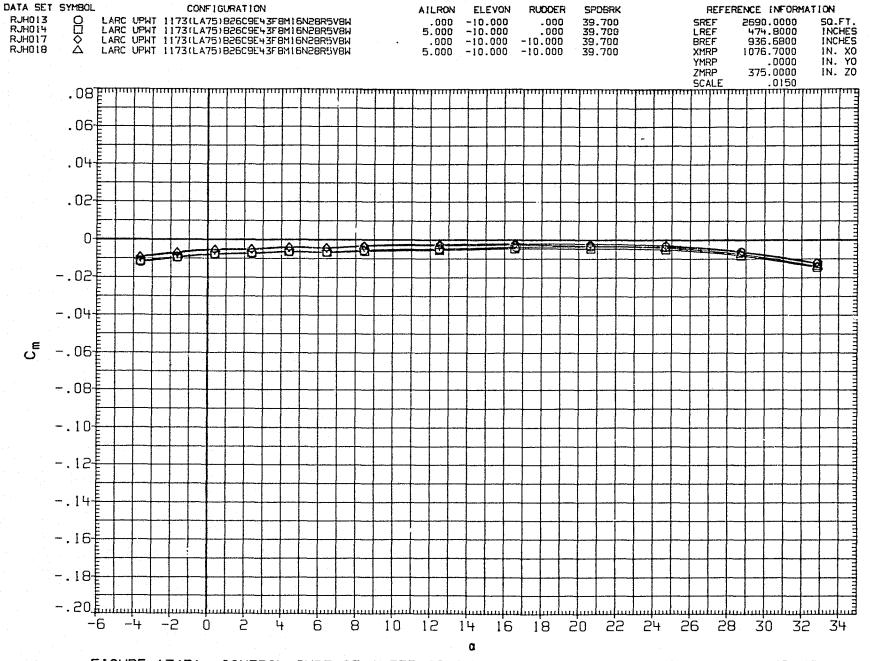


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE 416

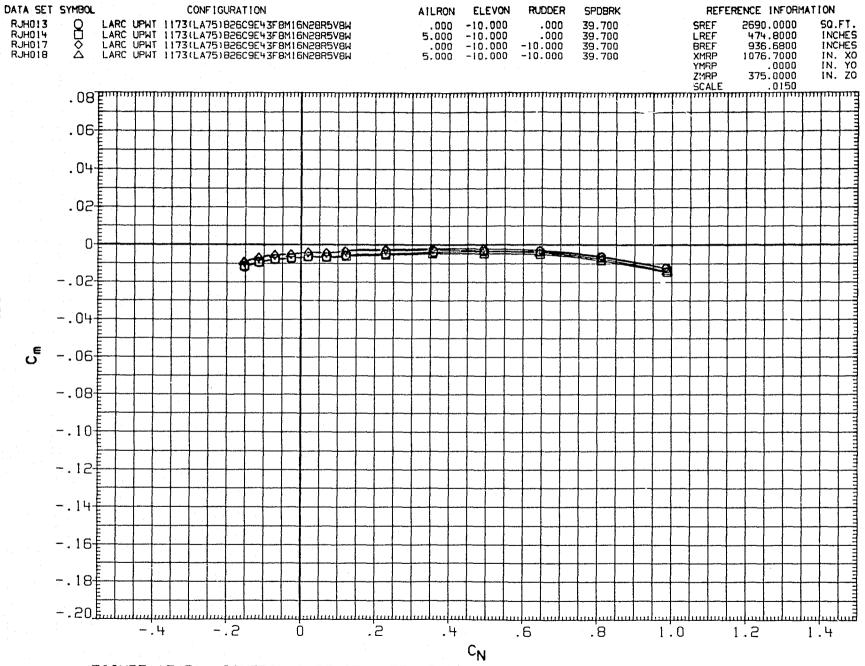


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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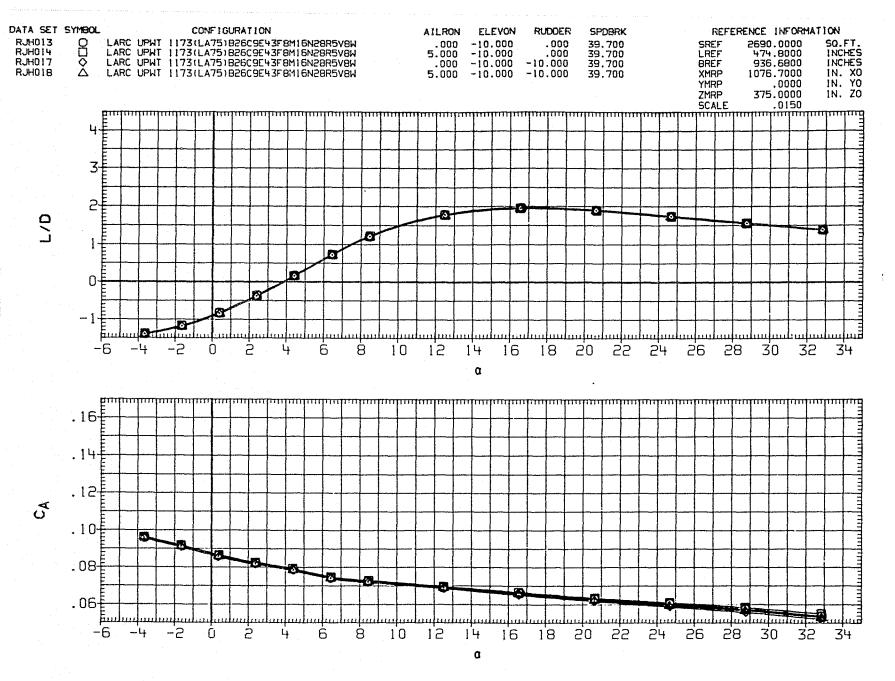
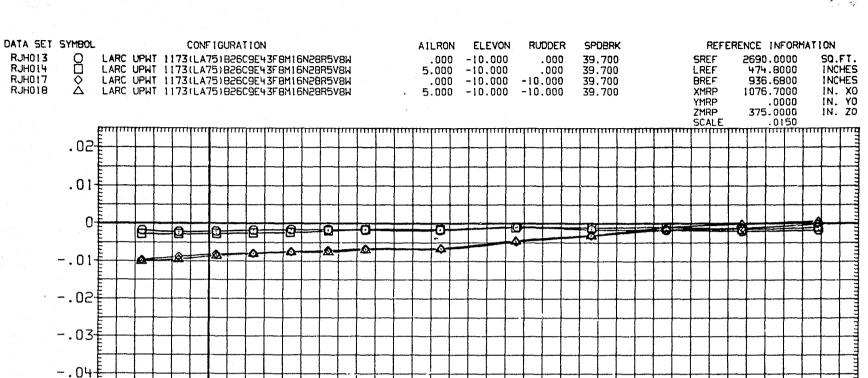


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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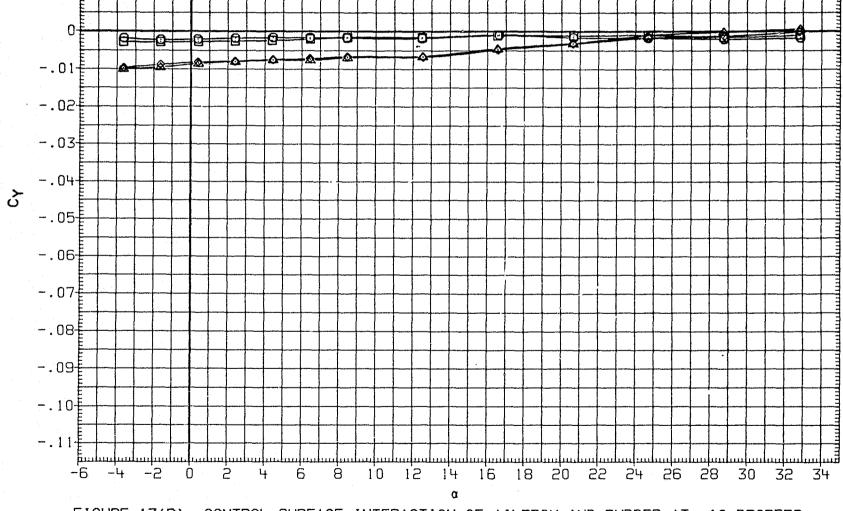


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE 419

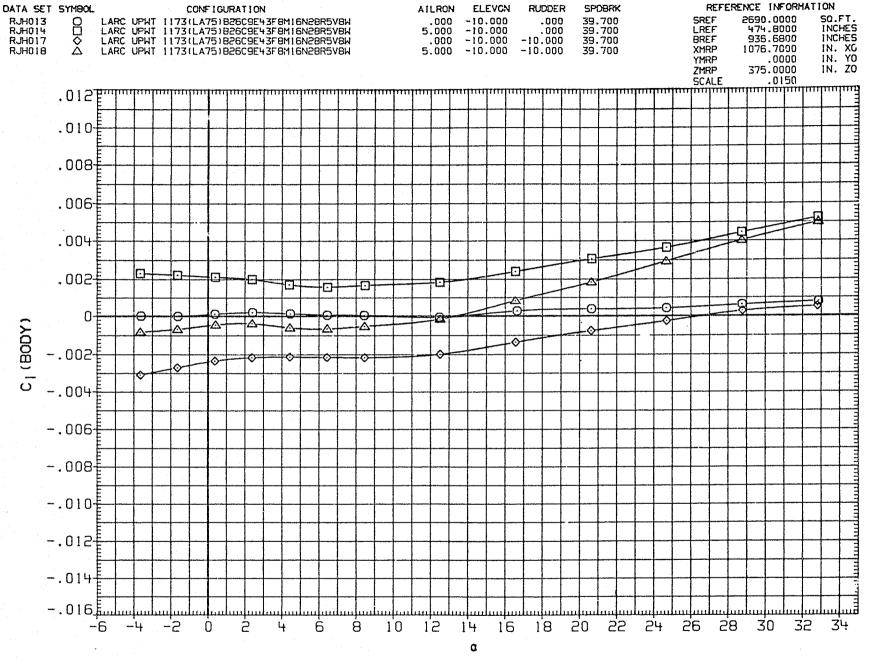


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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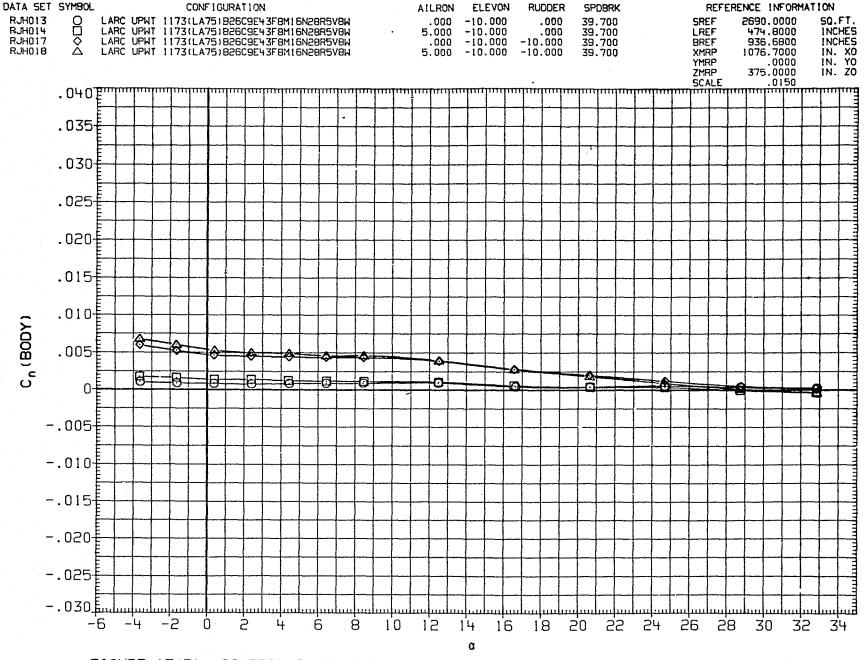


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90

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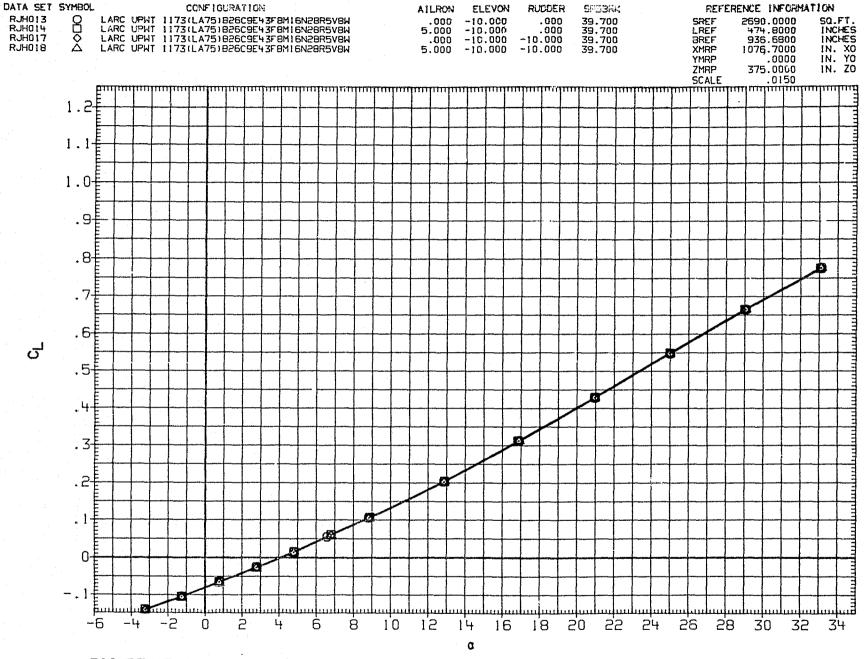


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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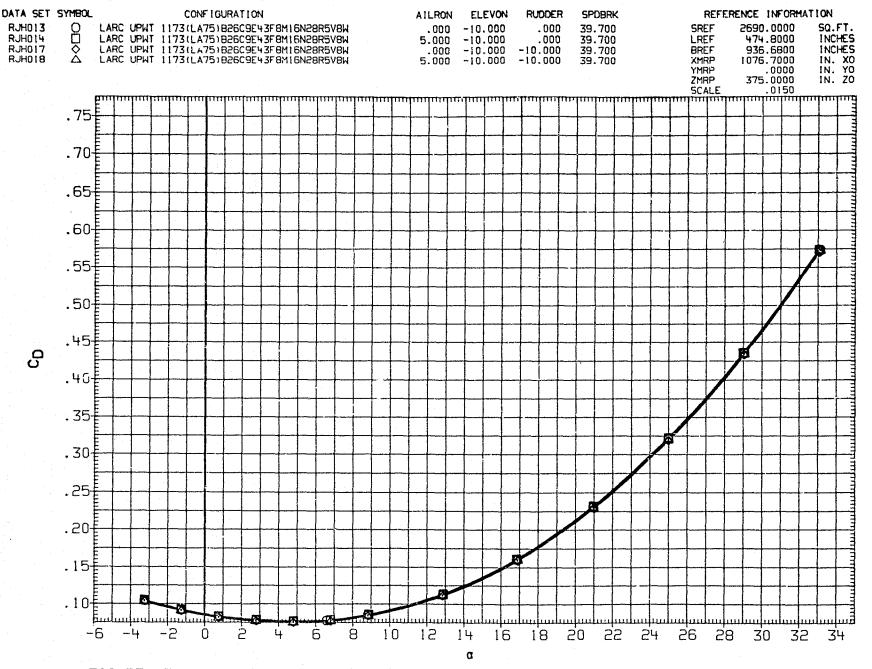


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C)MACH = 4.60

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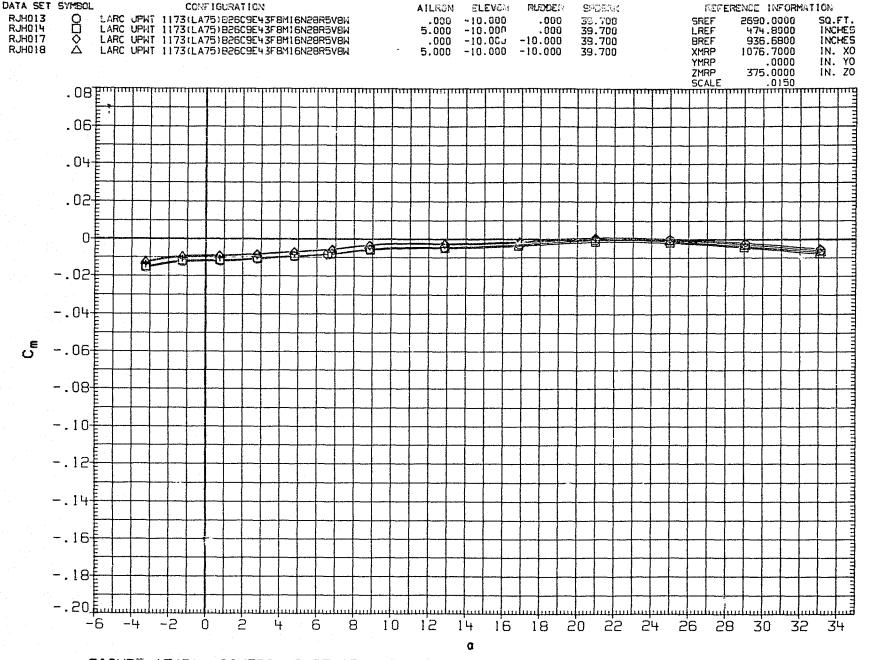


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60
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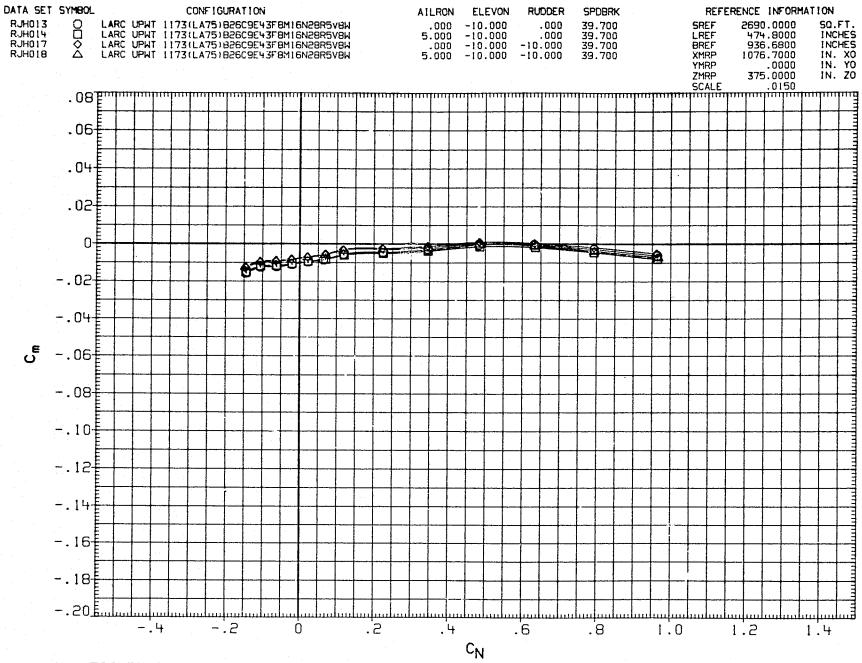


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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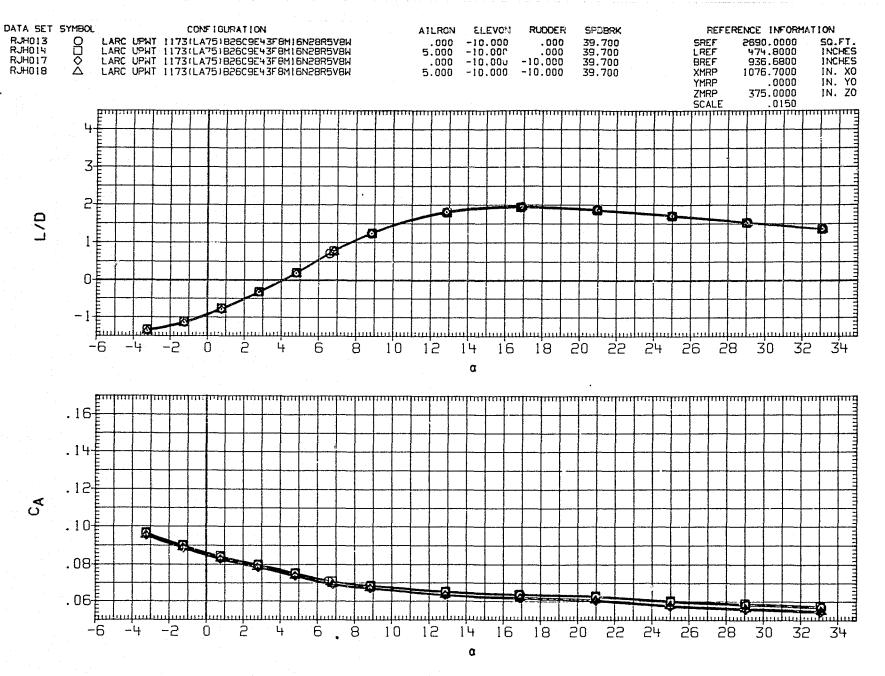


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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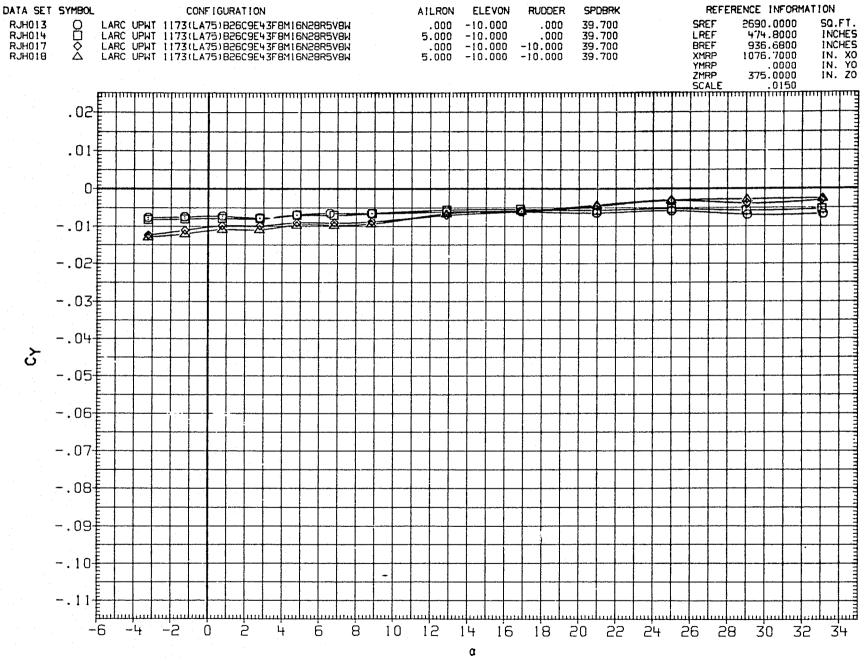


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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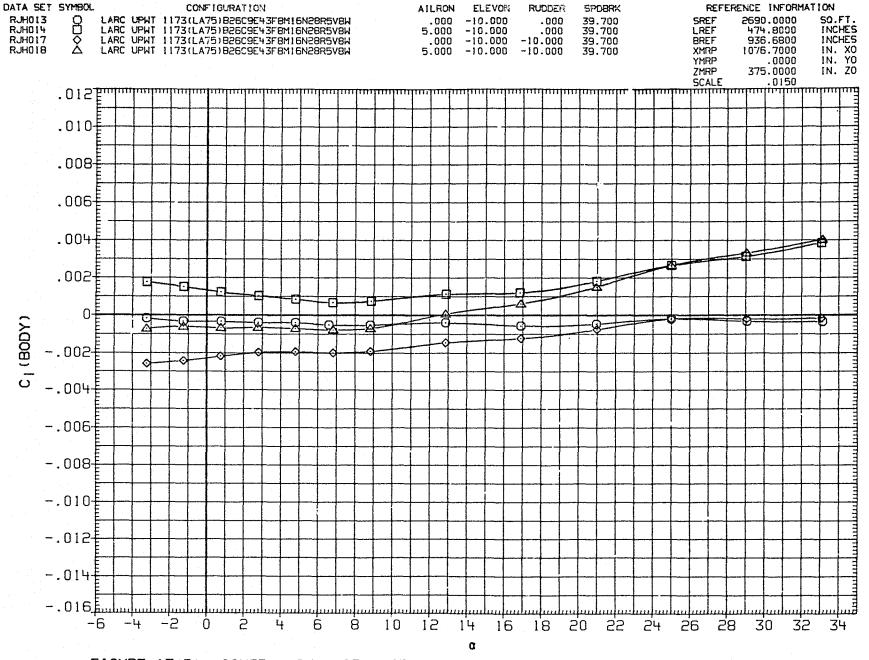


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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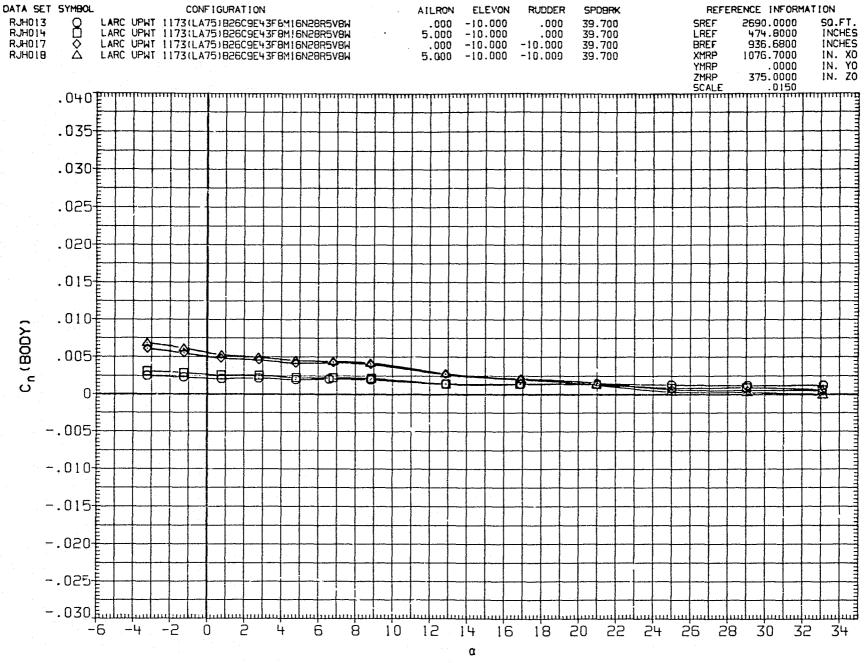


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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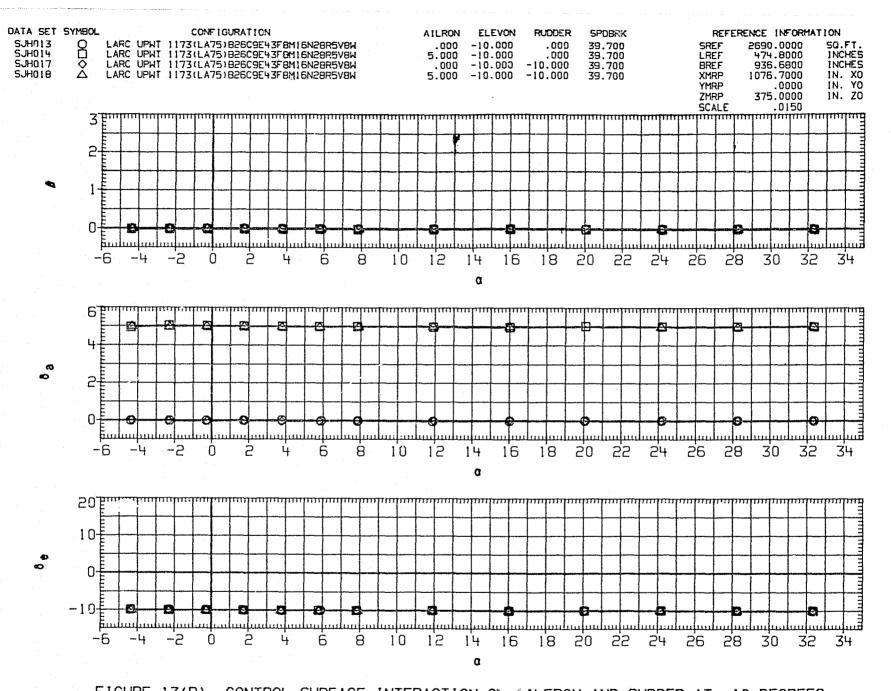


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86

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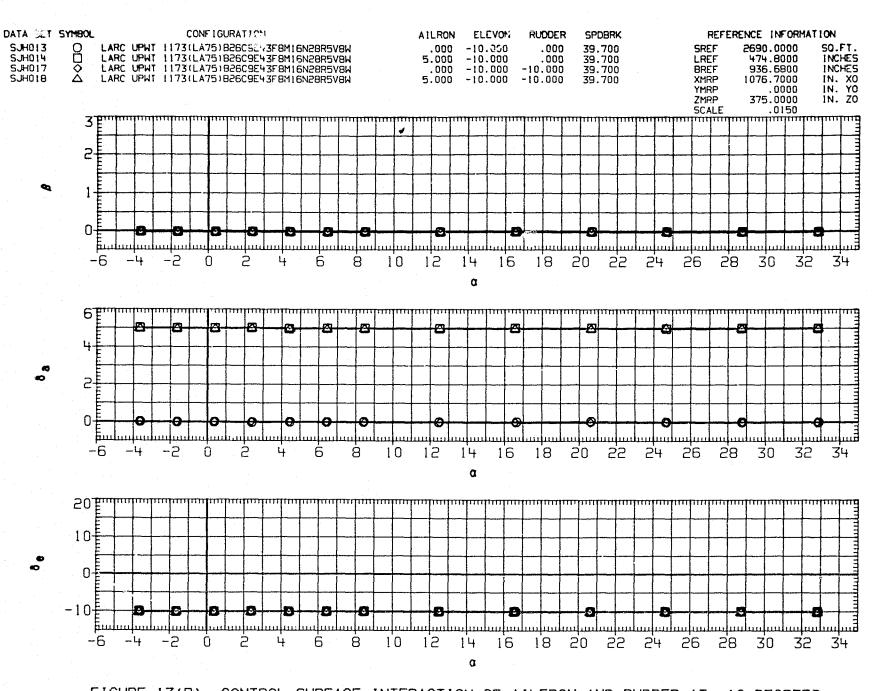


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(B)MACH = 3.90
PAGE 431

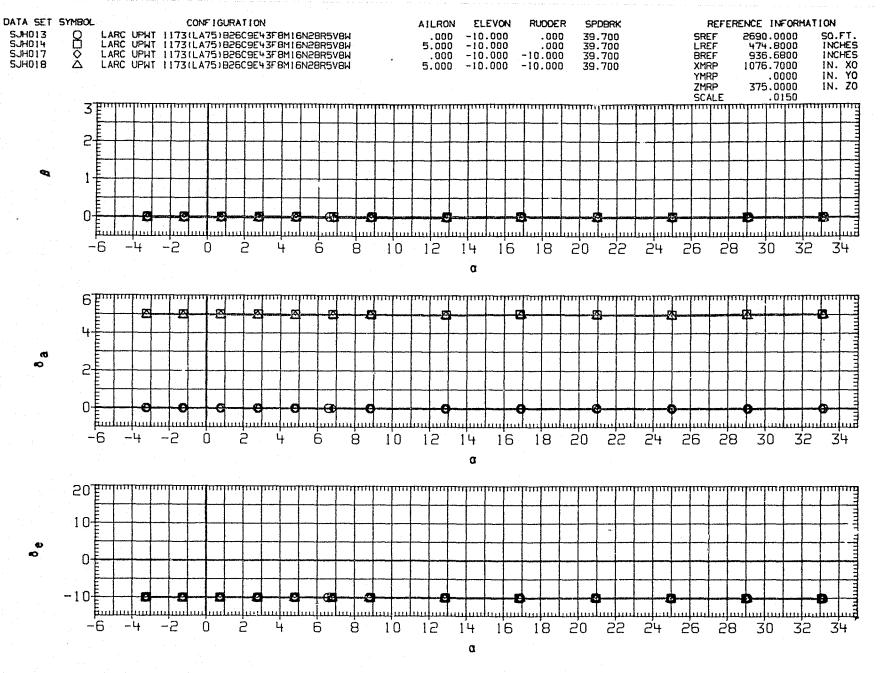
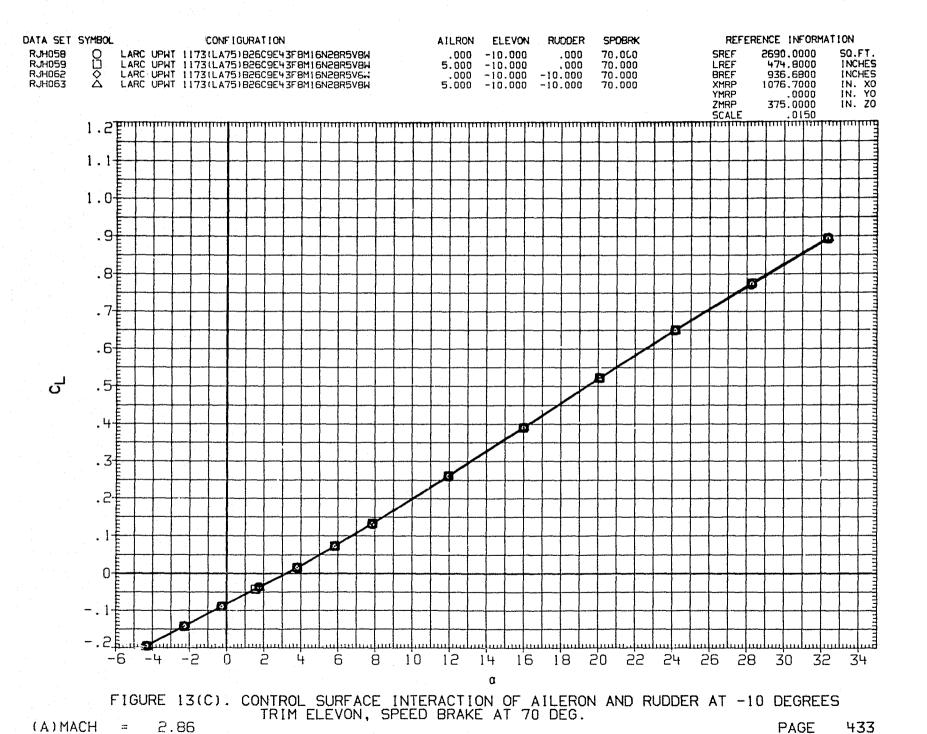


FIGURE 13(B). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60

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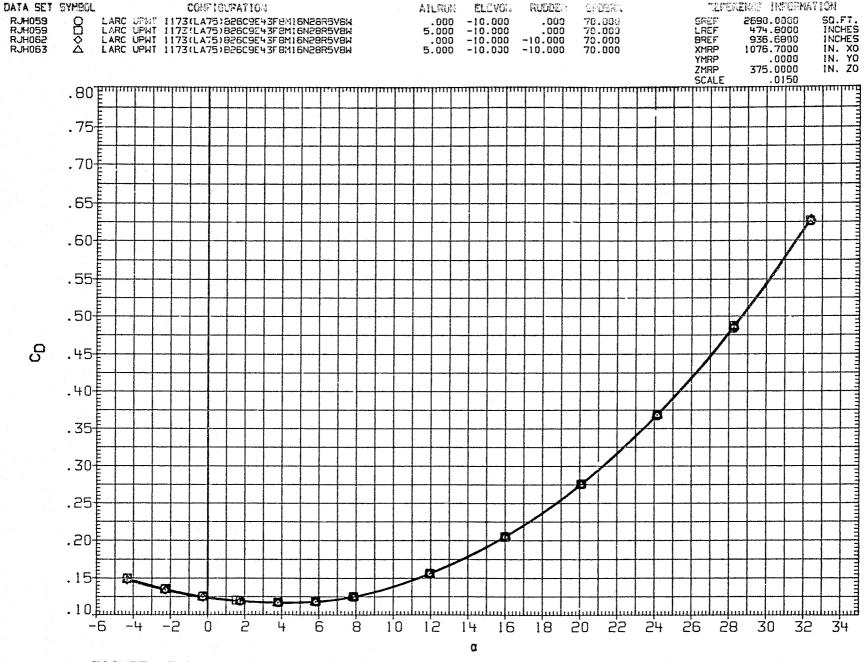


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86
PAGE 434

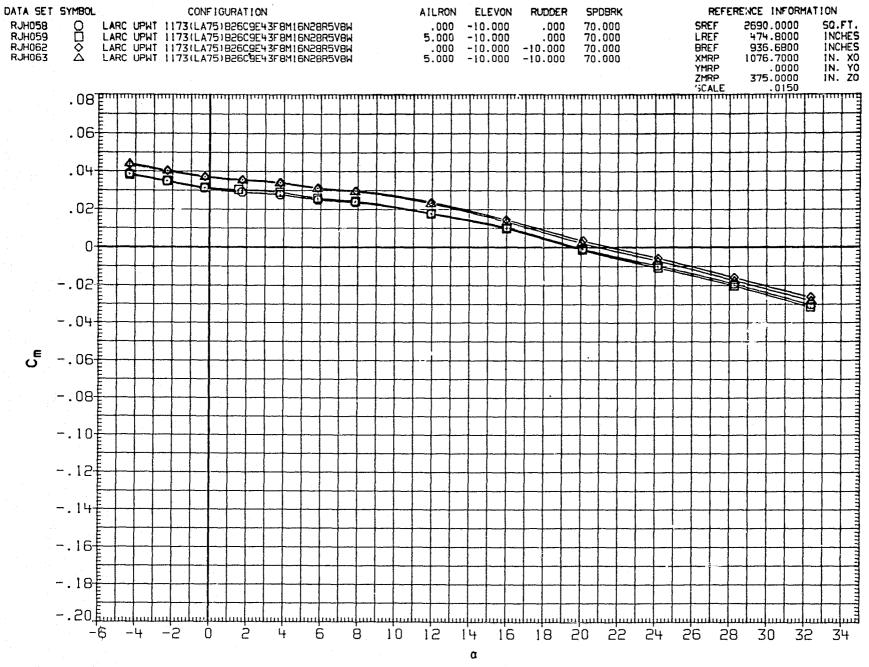


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

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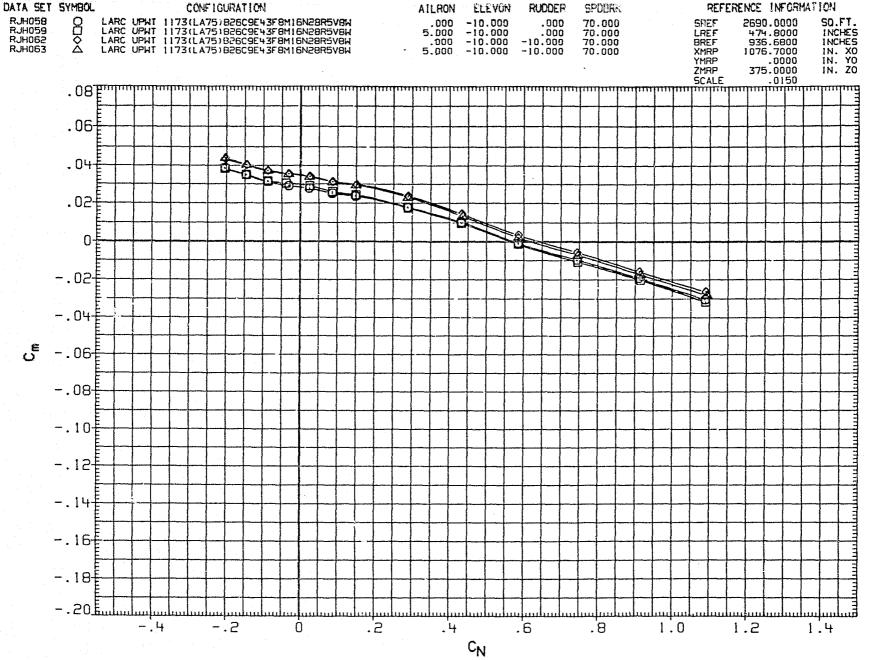


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

PAGE 436

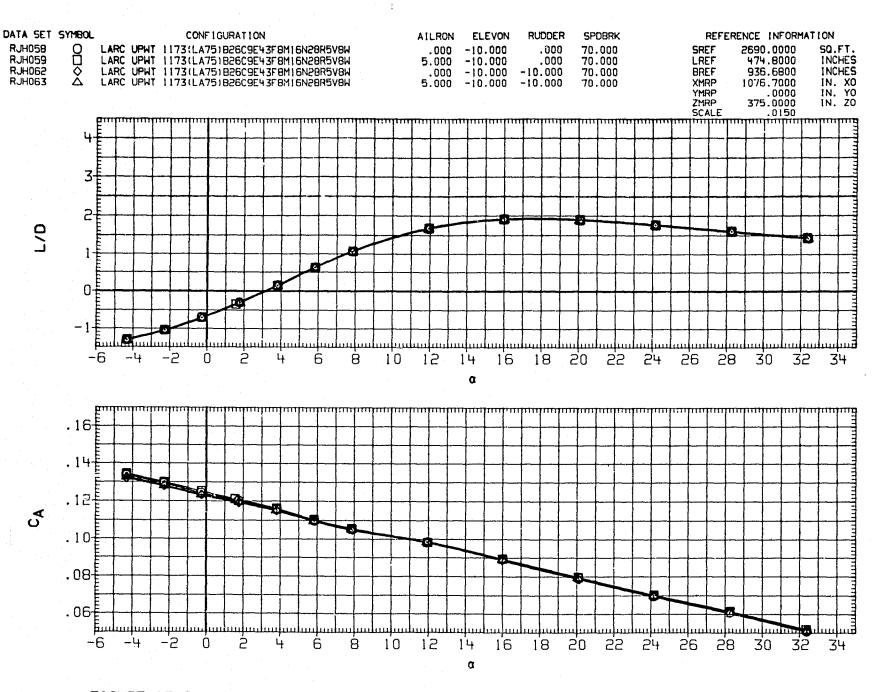


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

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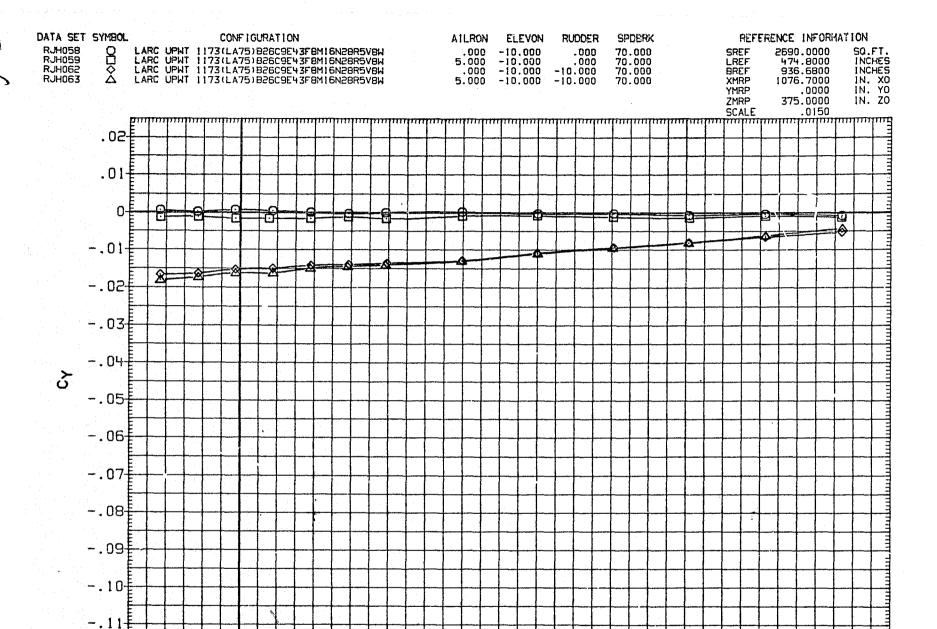


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

PAGE 438

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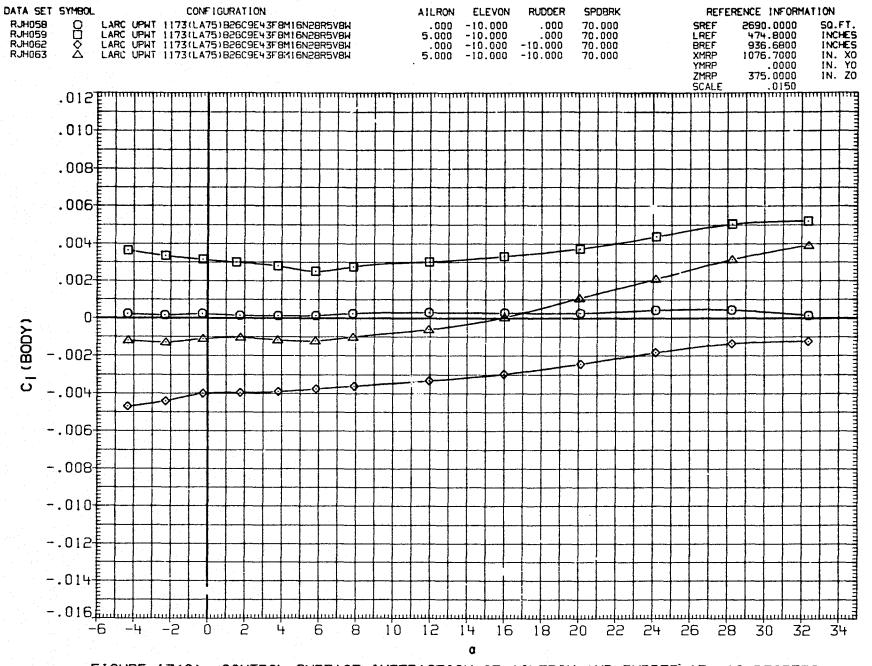


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A)MACH = 2.86

PAGE 439

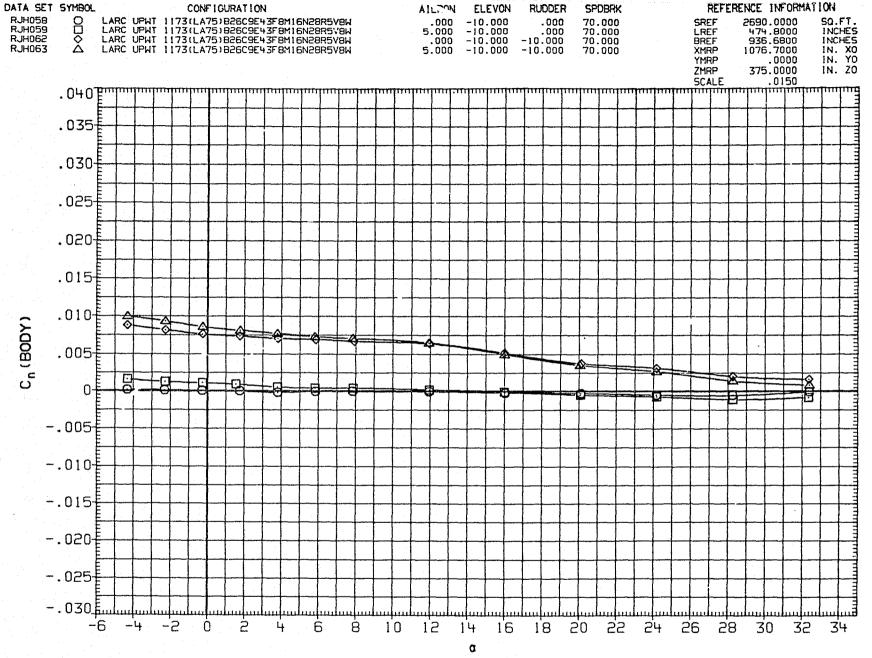
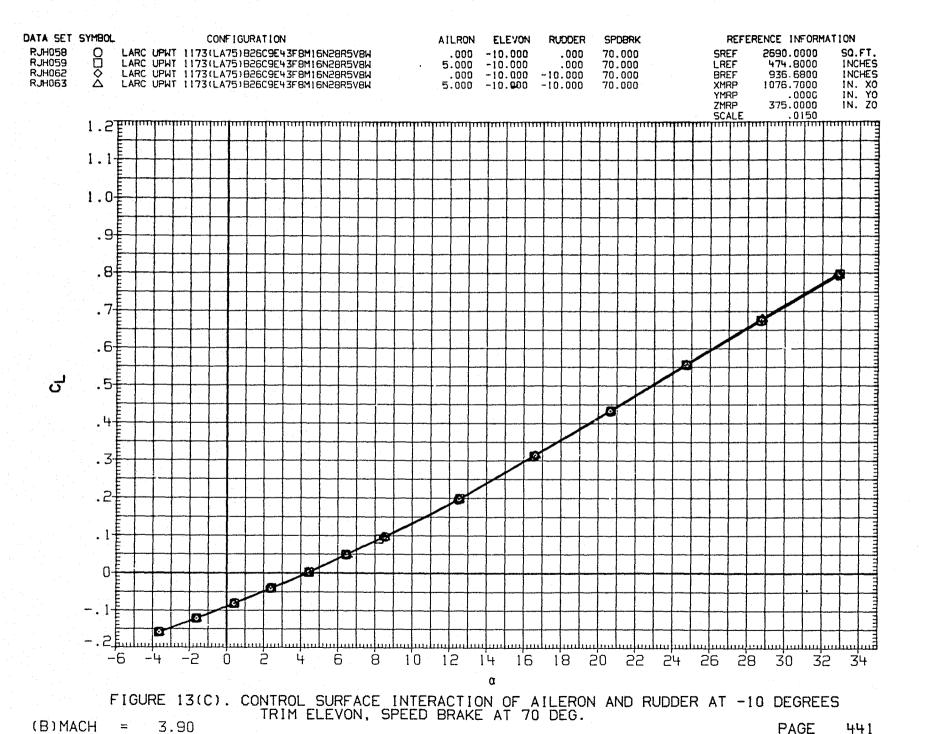


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

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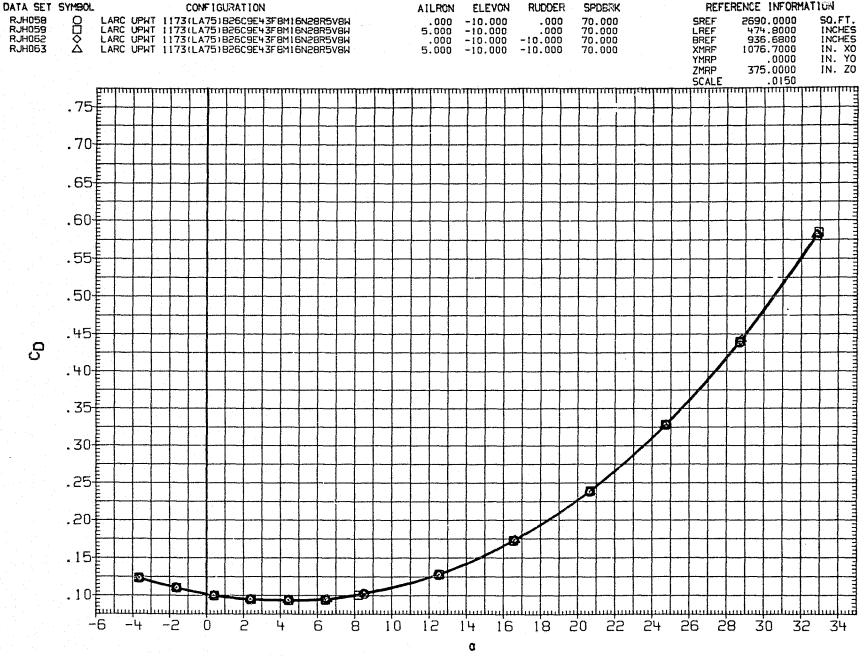


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

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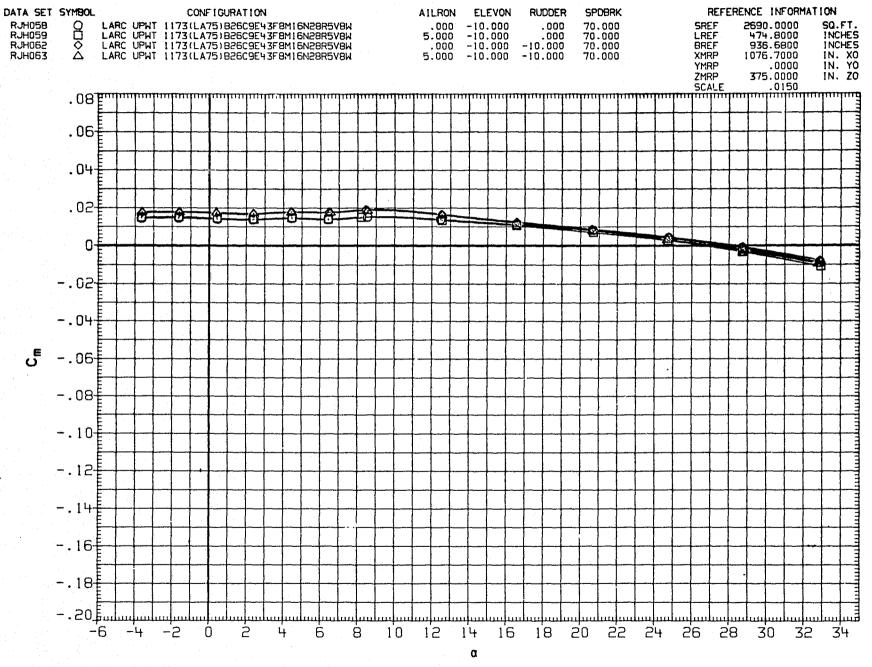
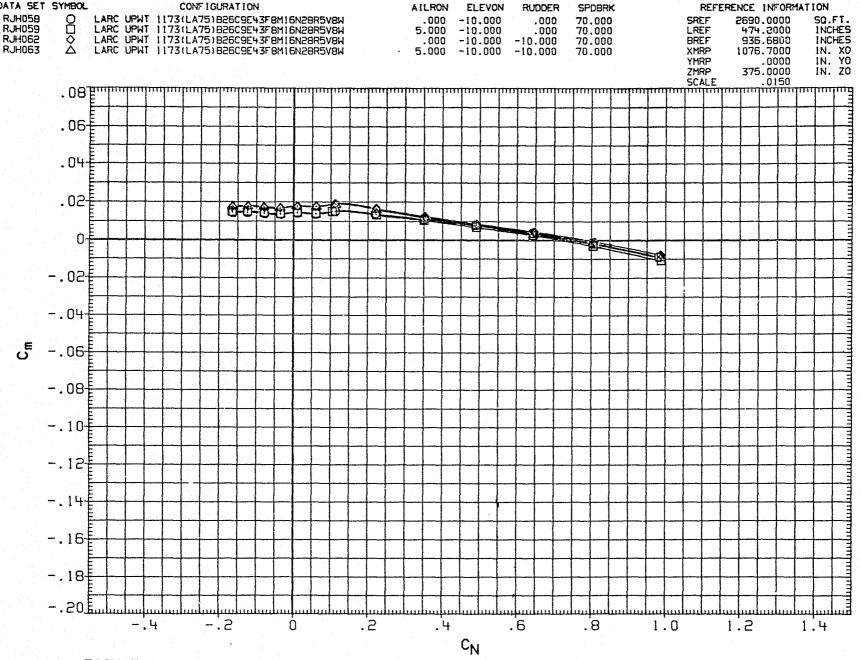


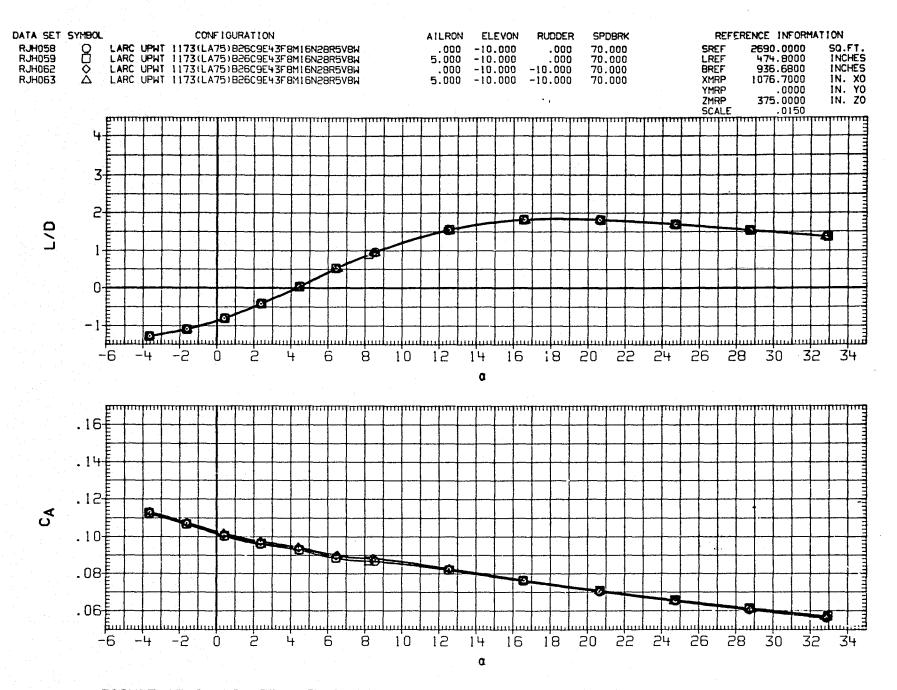
FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90
PAGE 443



DATA SET SYMBOL

FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 70 DEG. (B)MACH = 3.90PAGE 444



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FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90
PAGE 445

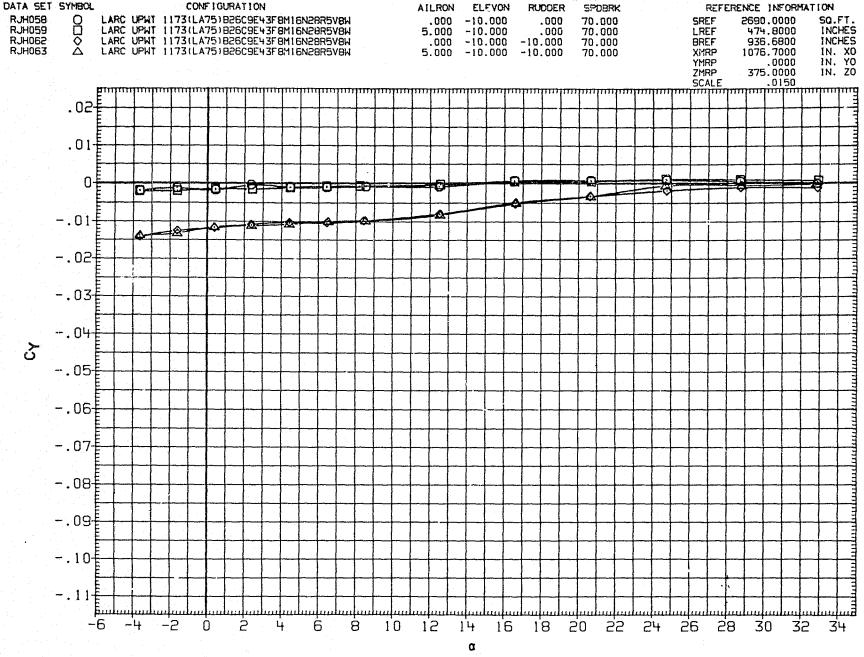


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

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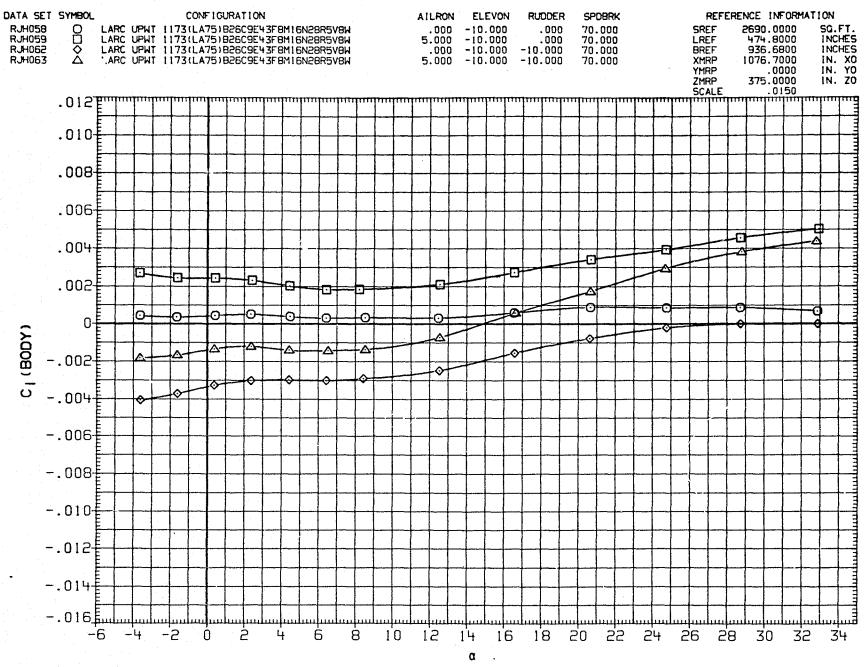


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

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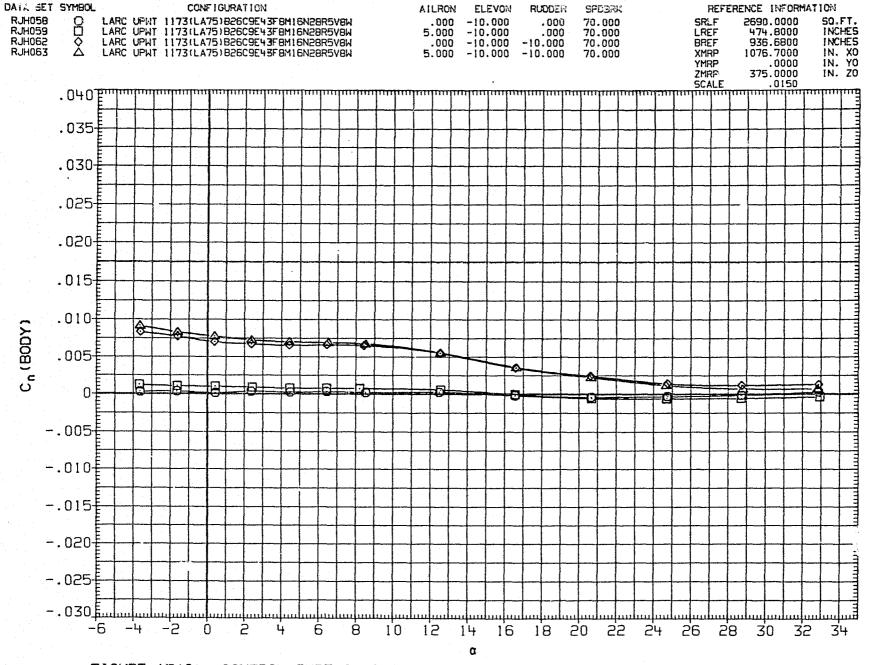


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

PAGE 448

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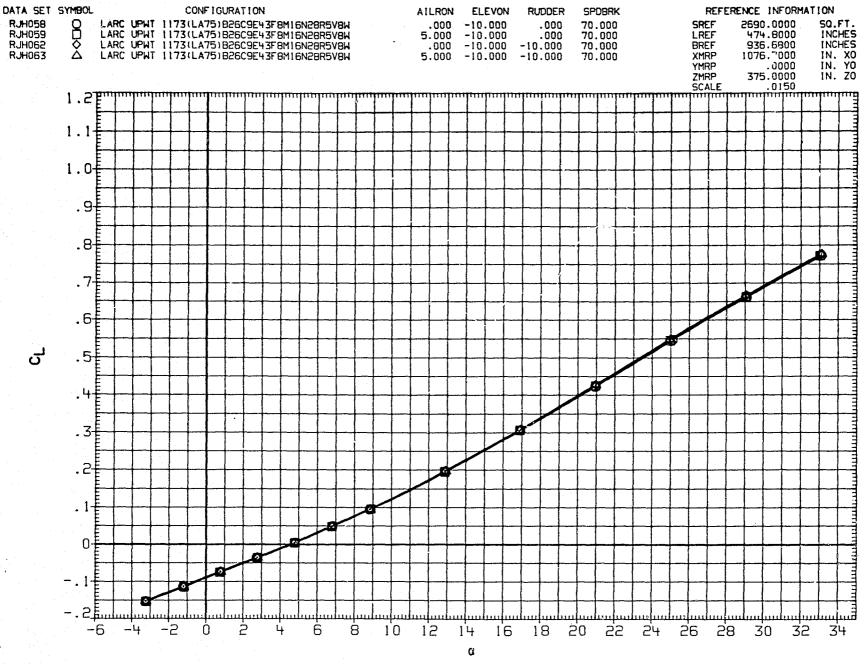
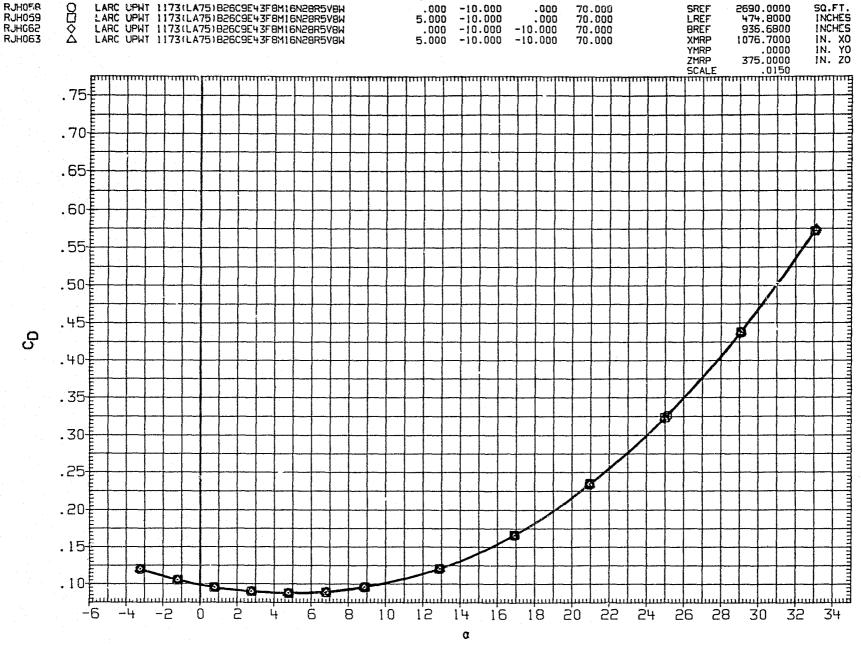


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

PAGE



AILRON ELEVON

RUDDER

SPDERK

REFERENCE INFORMATION

DATA SET SYMBOL

CONFIGURATION

FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

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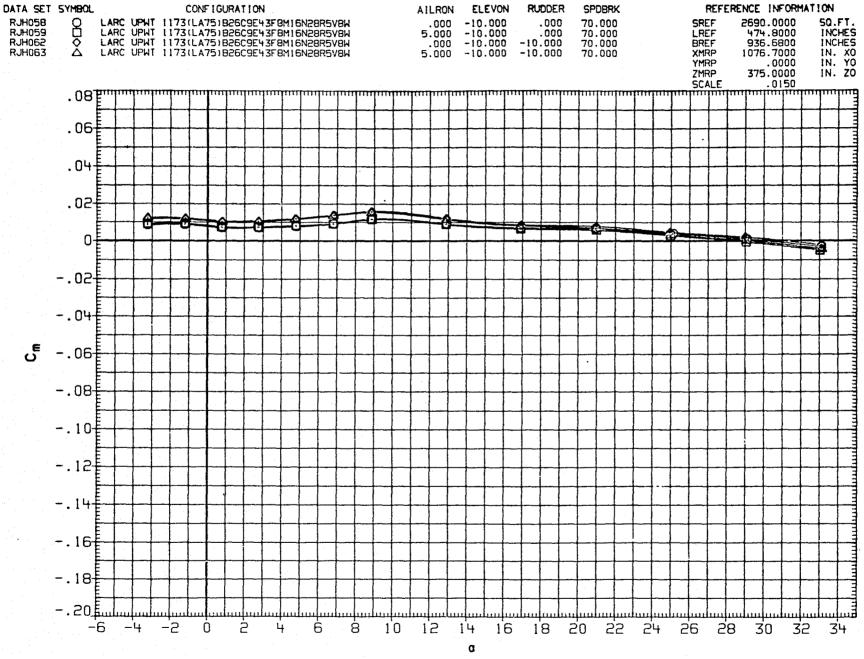


FIGURE 13(C). CCNTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60
PAGE 451

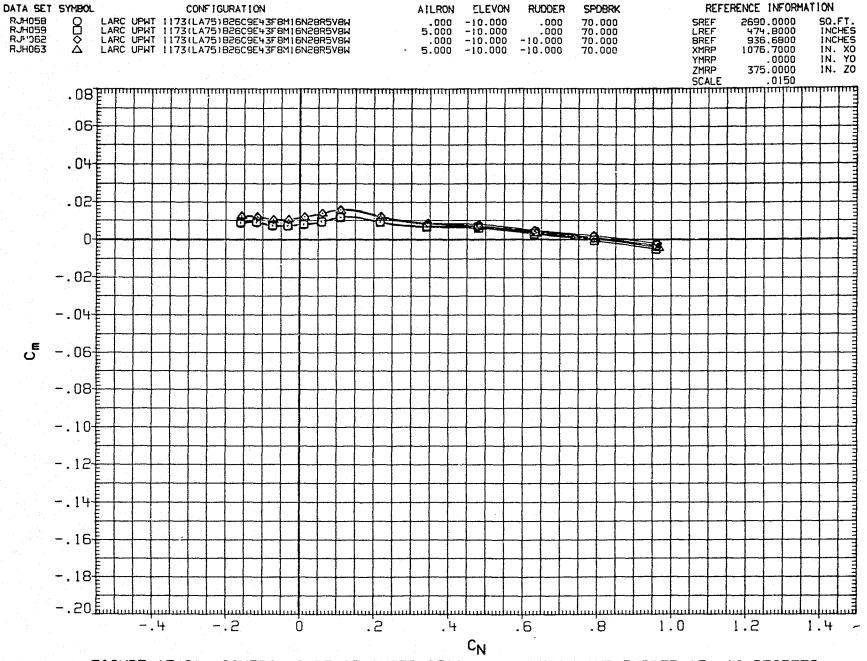


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

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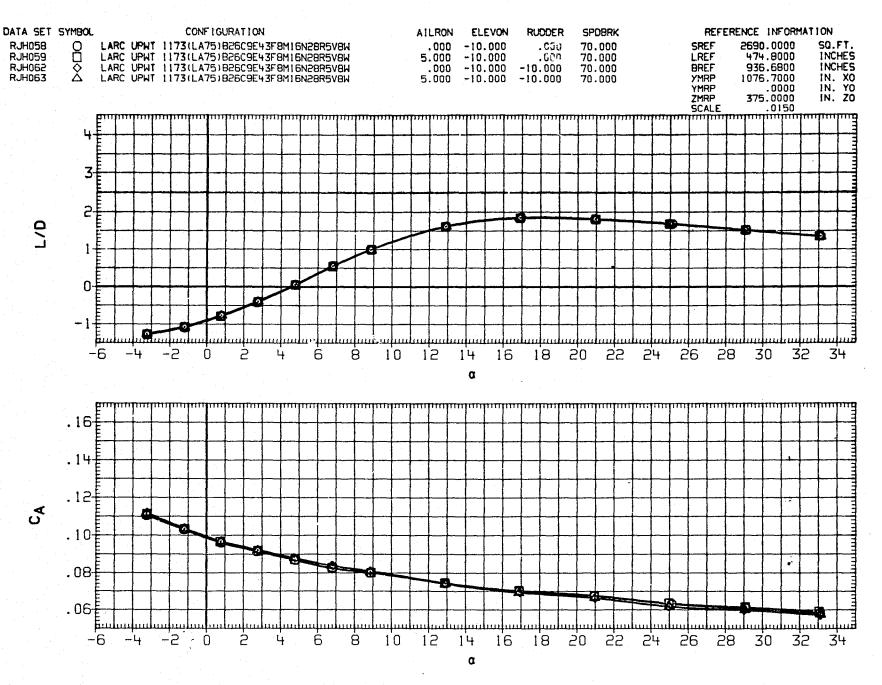


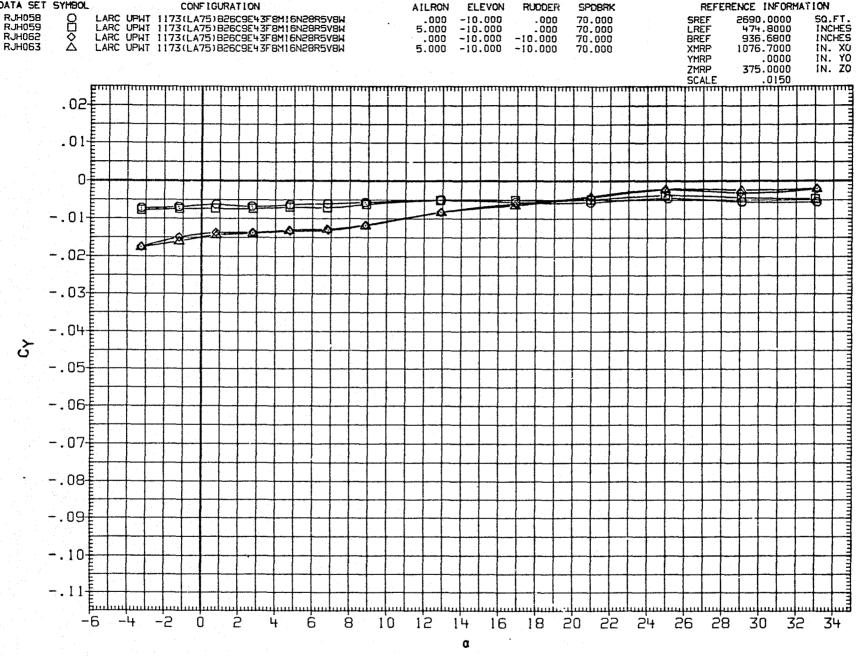
FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C)MACH = 4.60

PAGE 453

医乳腺管 化二氯基甲酚 医二甲基异丙基 医二氏管 医二氯化二烷



DATA SET SYMBOL

FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 70 DEG. (C)MACH = 4.60 454 PAGE

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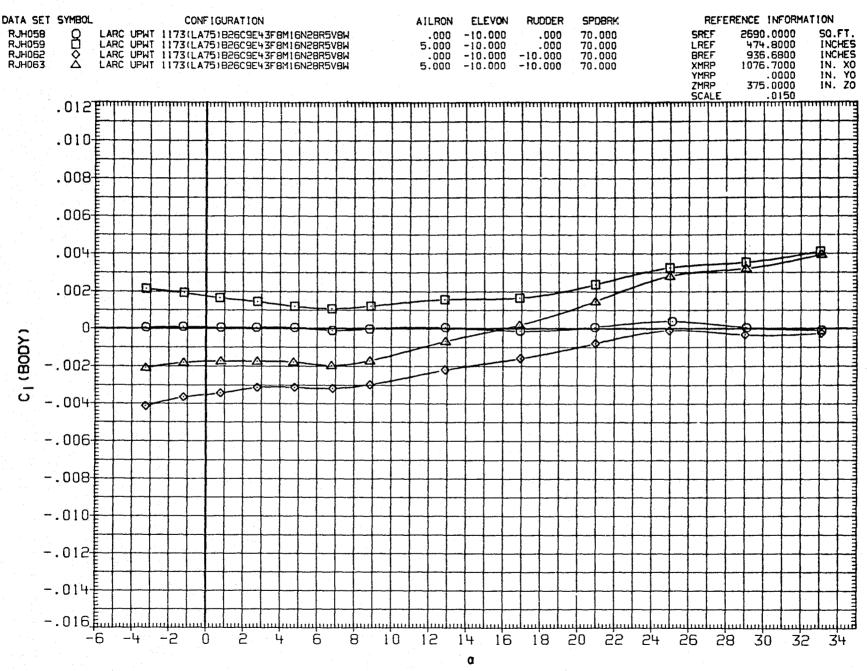


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C) MACH = 4.60

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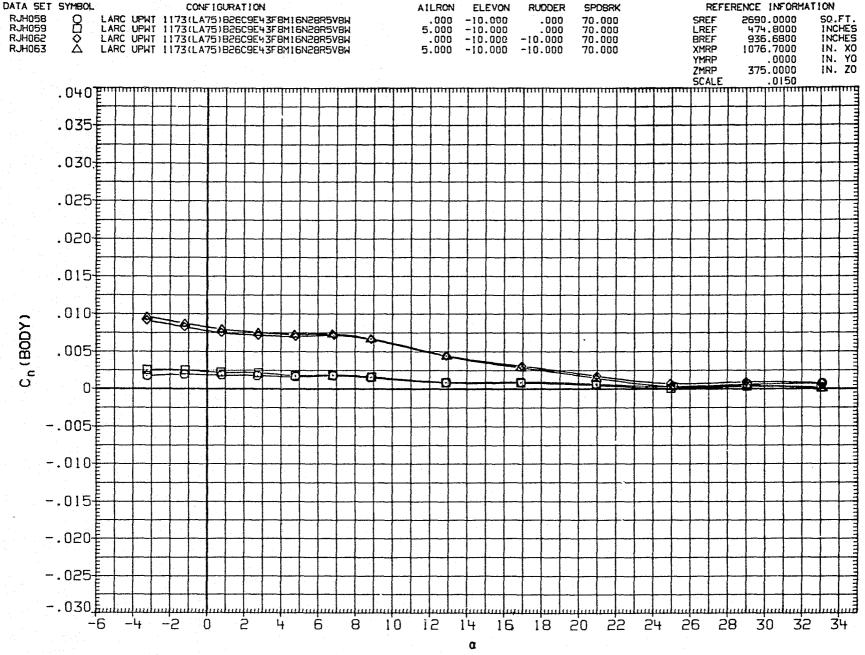


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(C)MACH = 4.60

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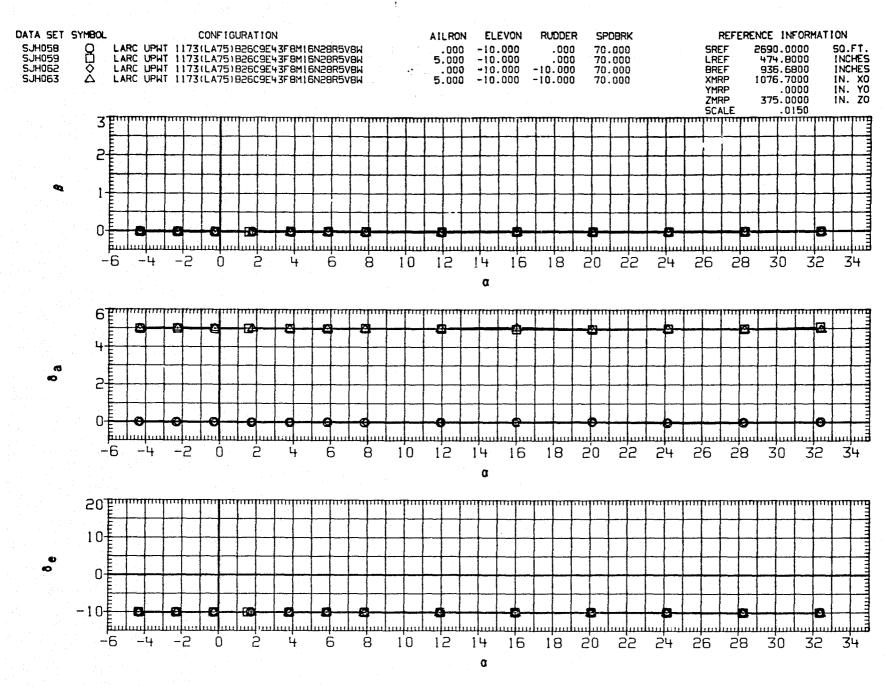


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(A) MACH = 2.86

PAGE

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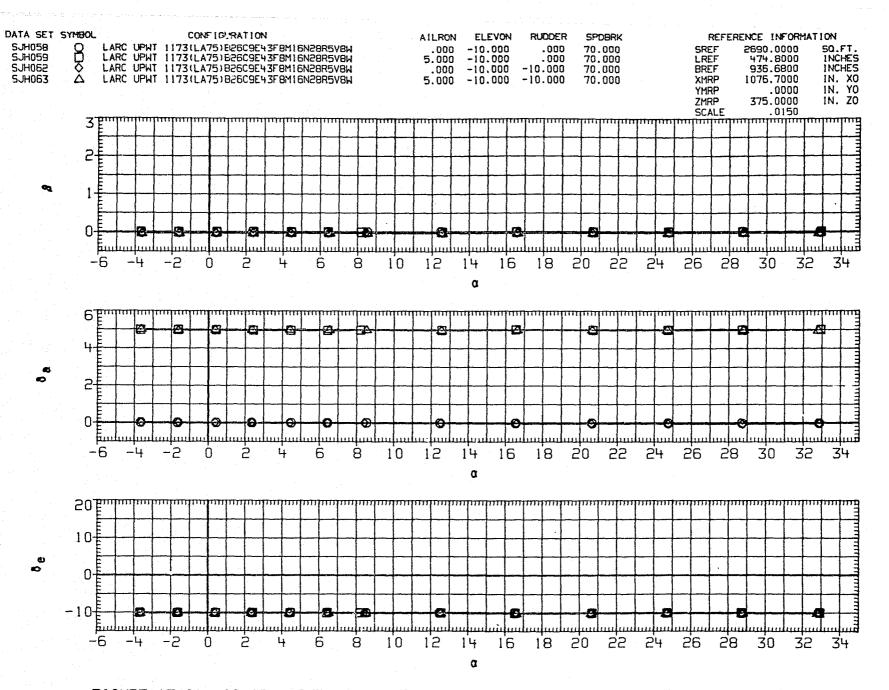


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 70 DEG.

(B) MACH = 3.90

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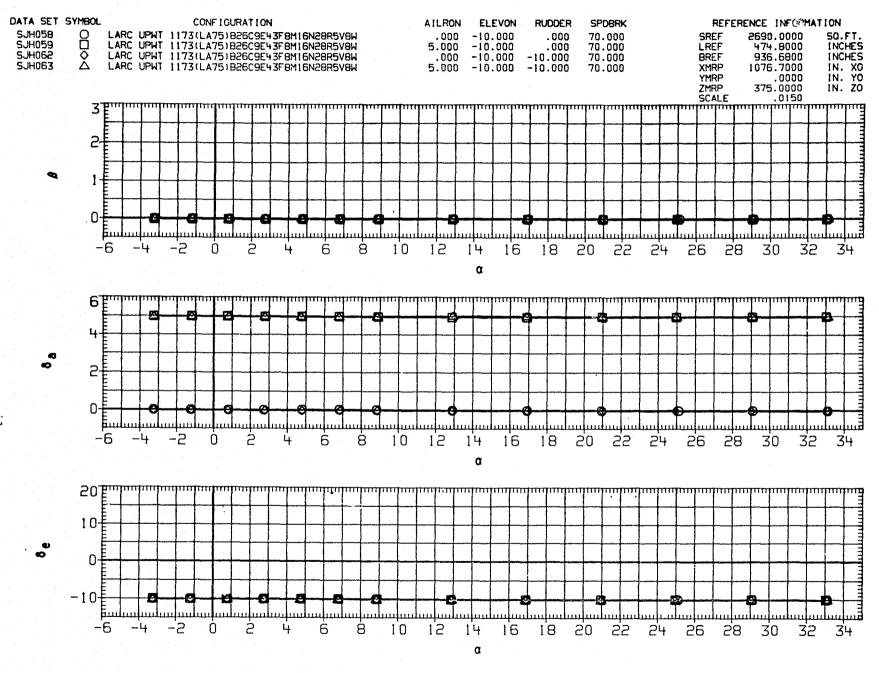


FIGURE 13(C). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 70 DEG. (C) MACH 4.60

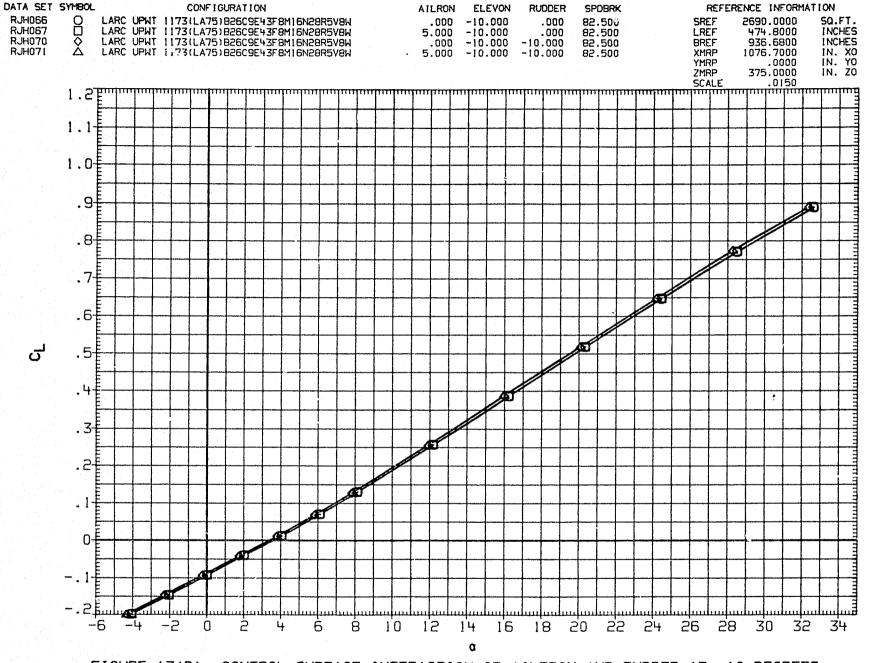


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A)MACH = 2.86

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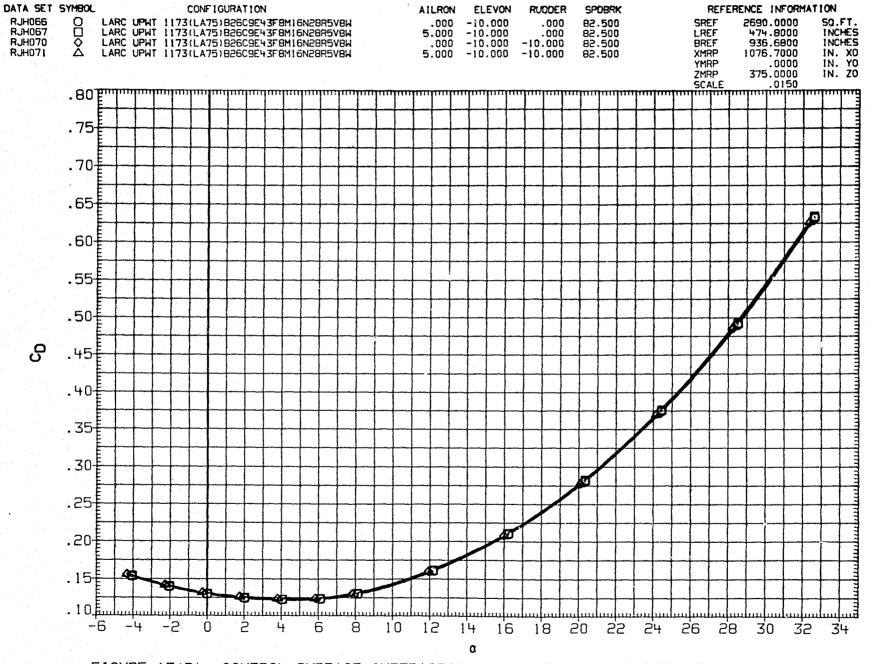


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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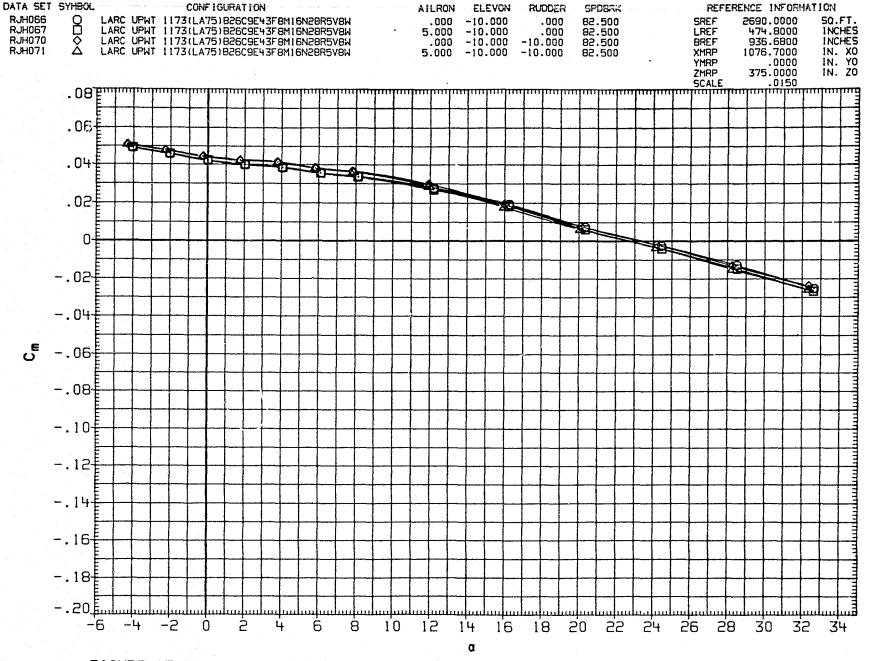


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

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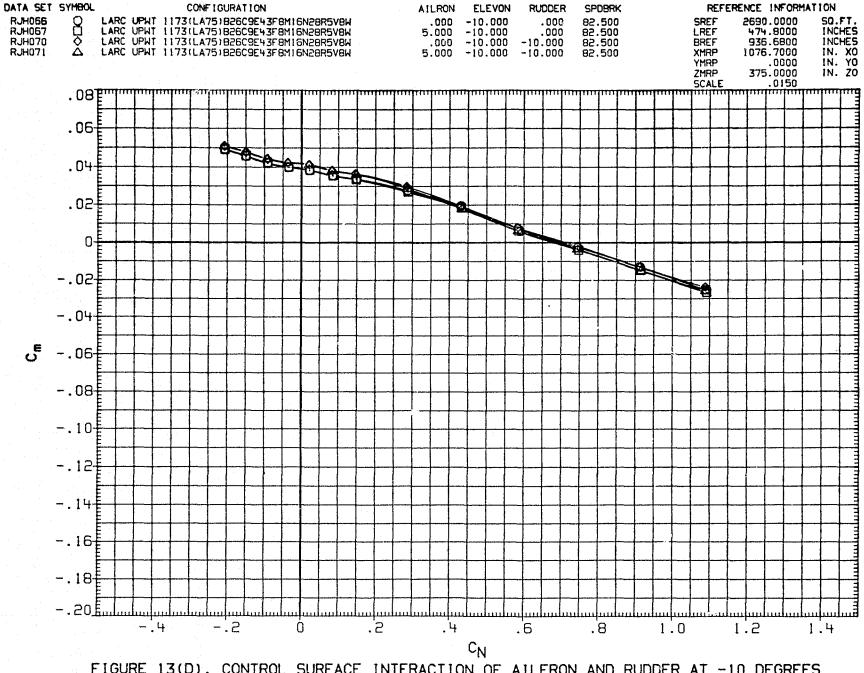


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A)MACH = 2.86

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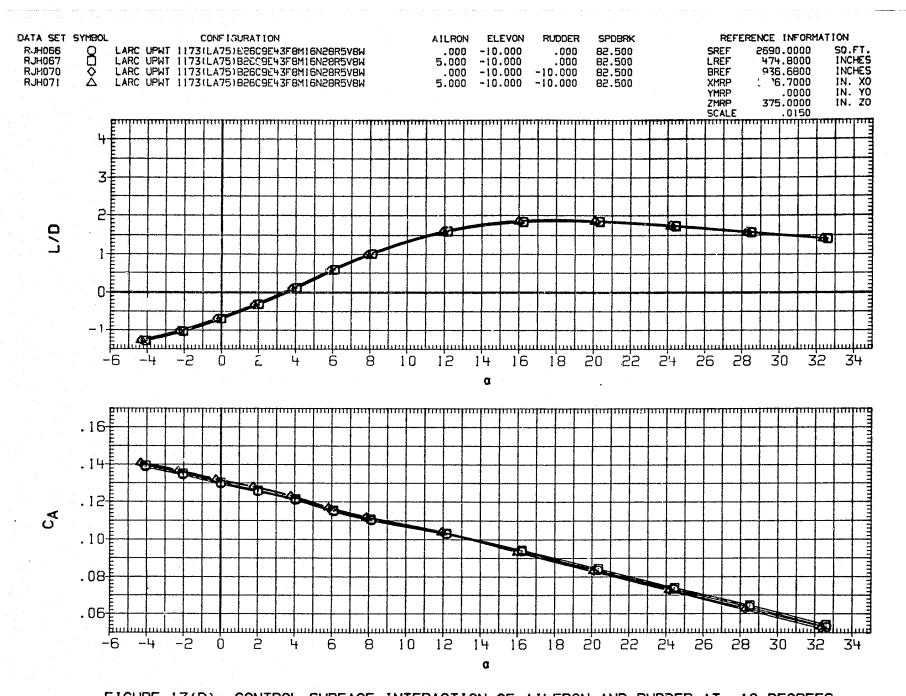


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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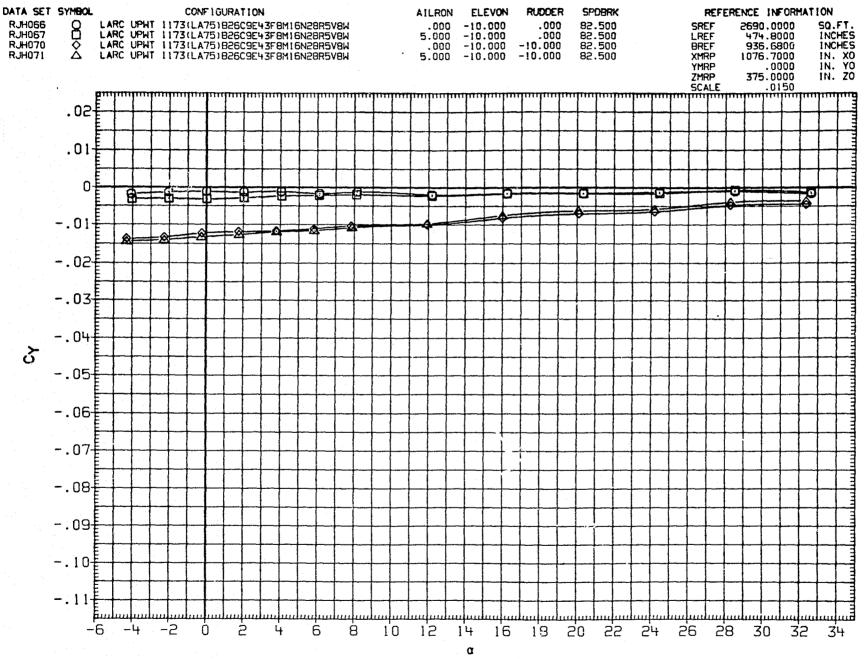


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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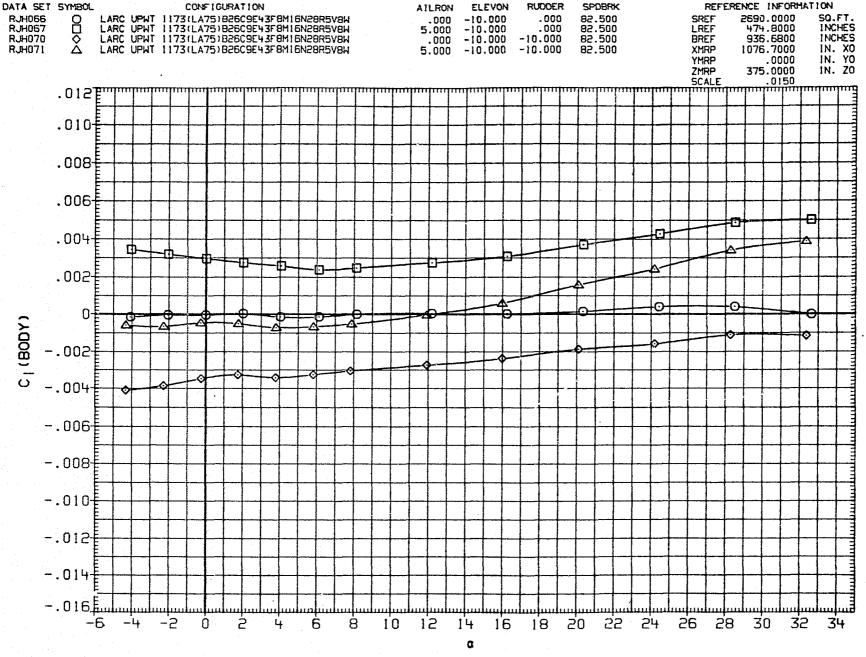


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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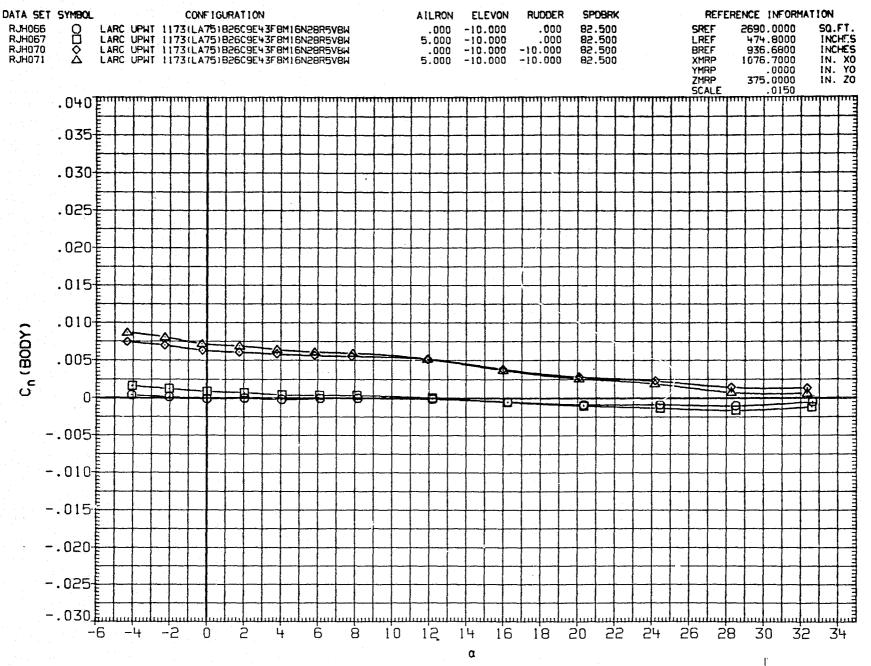


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86
PAGE 467

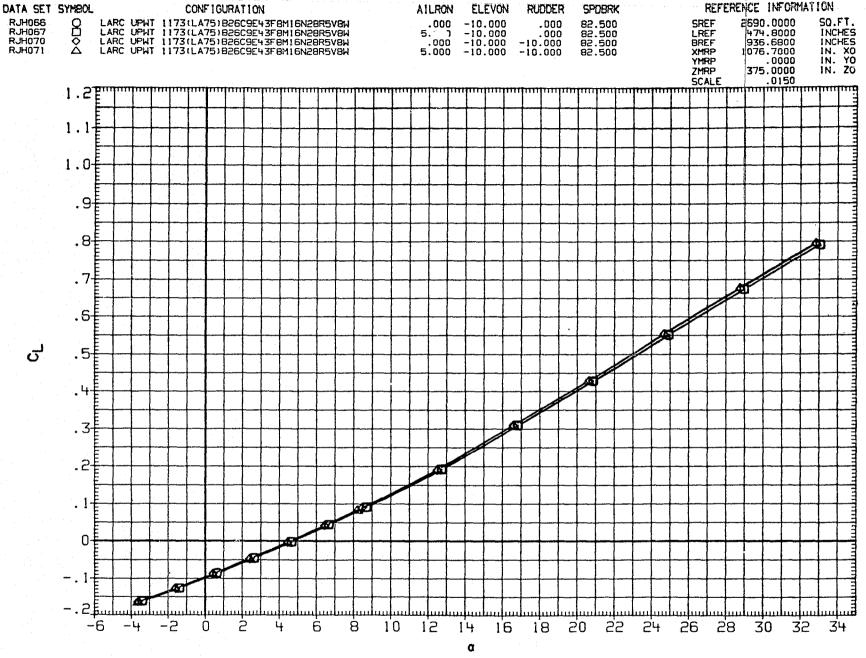


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90

PAGE 468

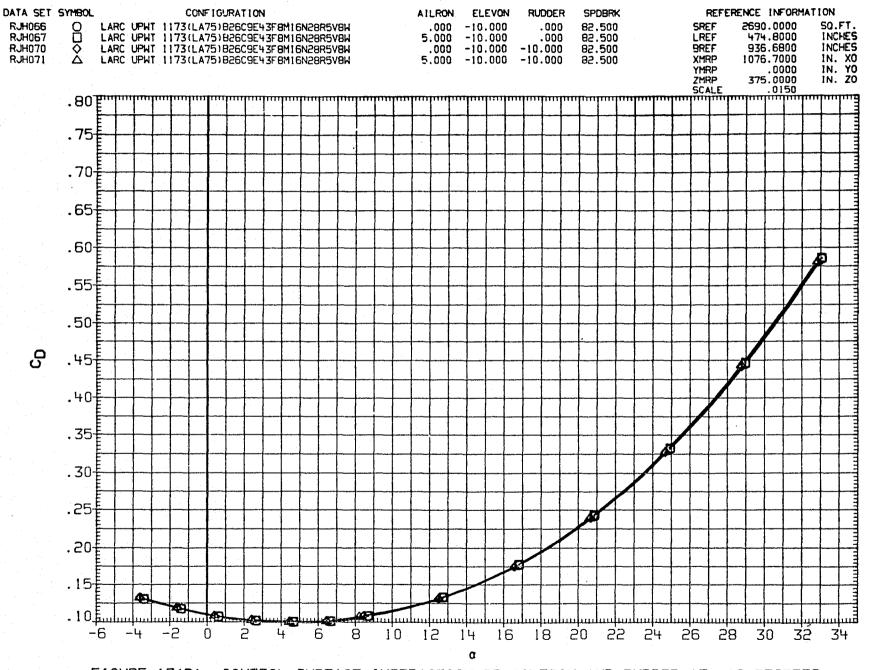


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
PAGE 469

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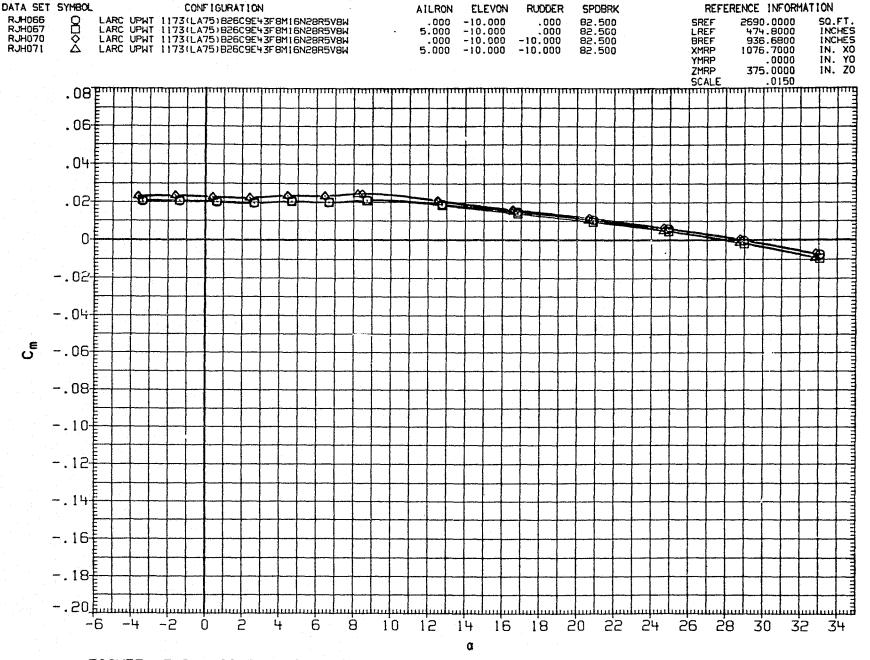


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90

PAGE 470

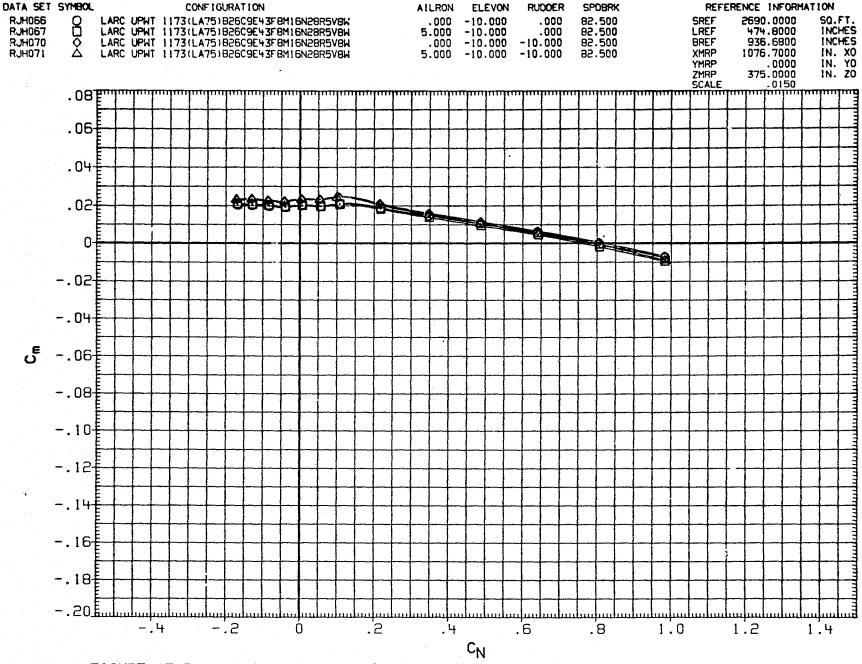


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90

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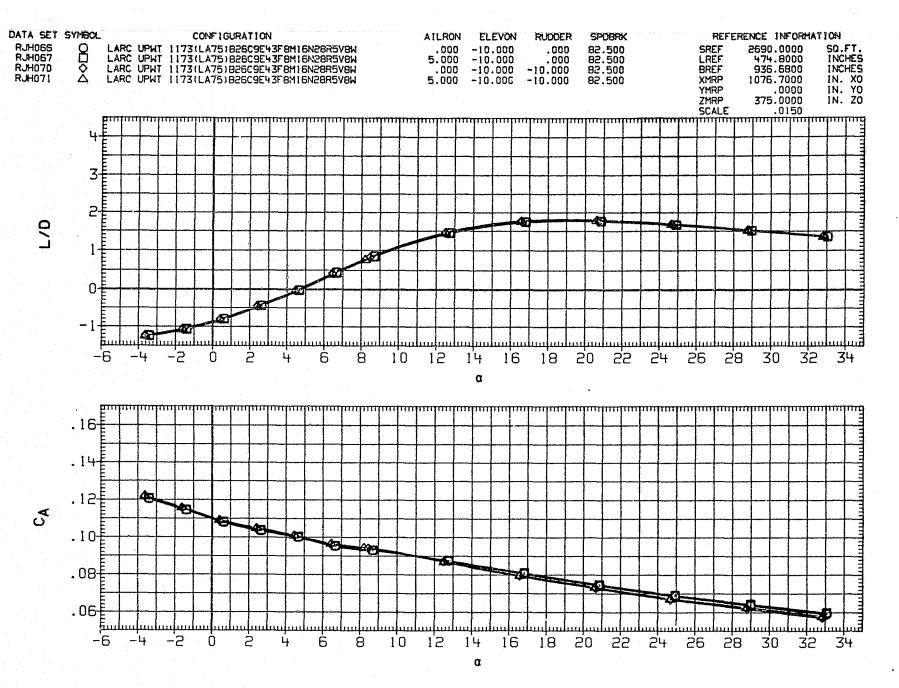


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
PAGE 472

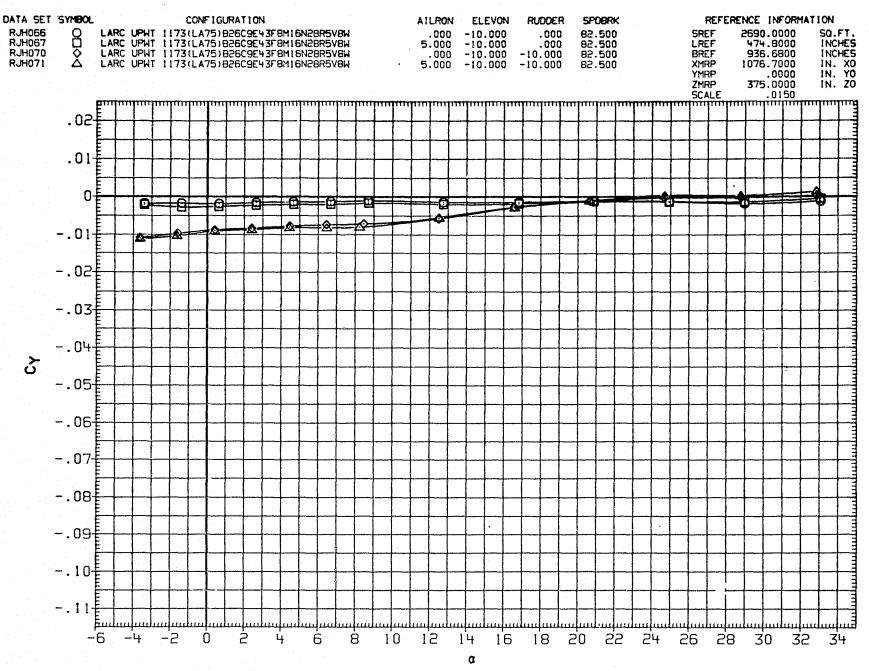


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 82.5 DEG. 3.90 PAGE

(B) MACH

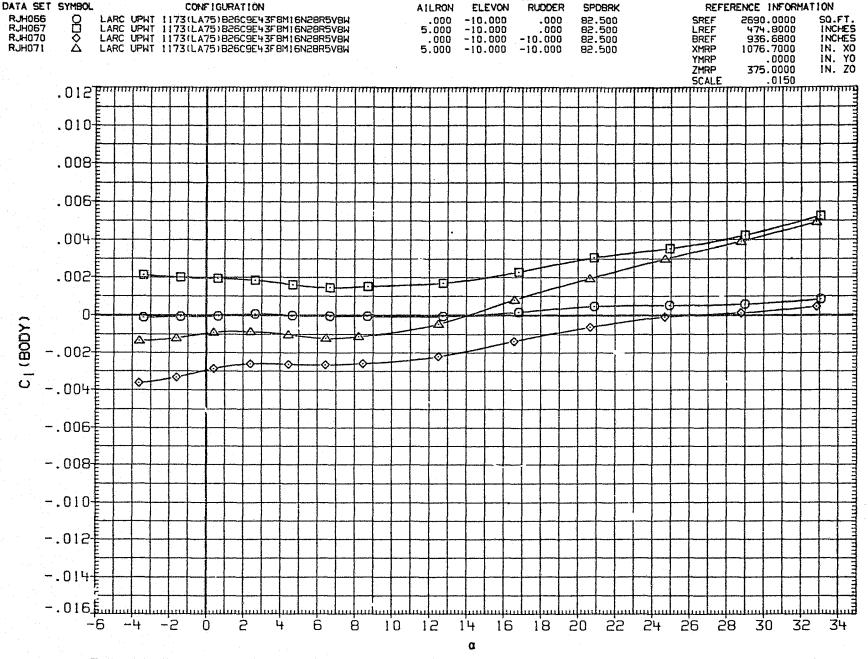


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90

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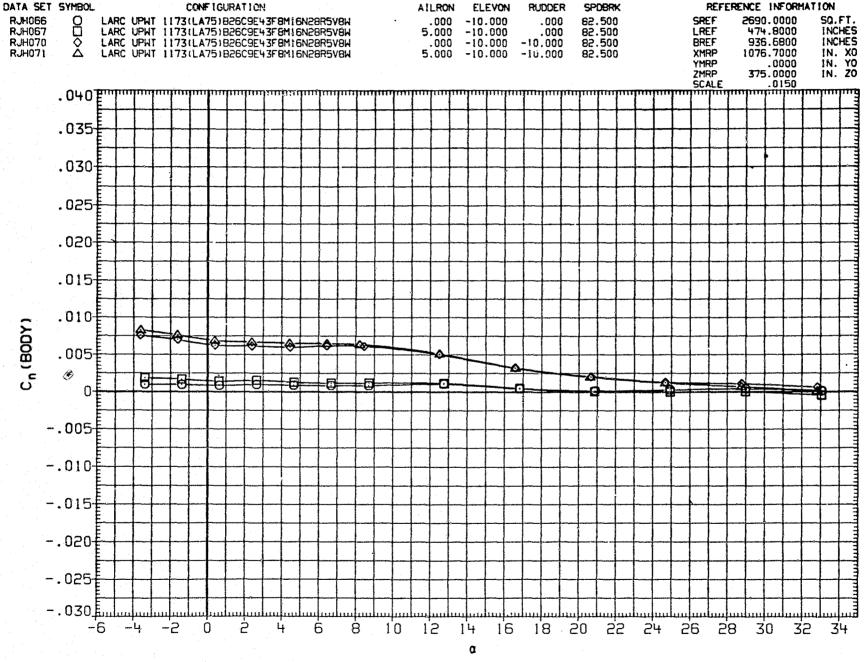
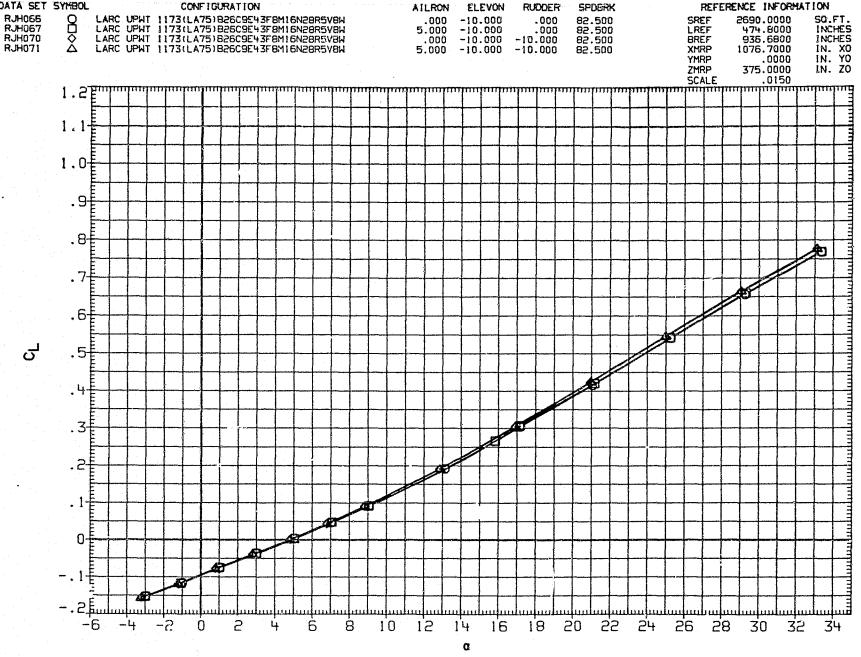


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
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DATA SET SYMBOL

FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES TRIM ELEVON, SPEED BRAKE AT 82.5 DEG. (C)MACH = 4.60476 PAGE

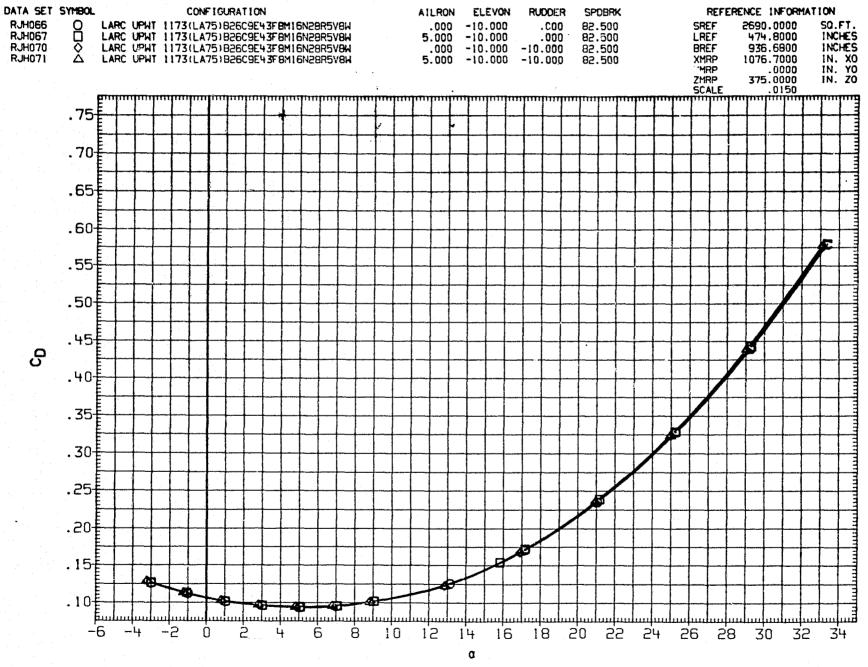


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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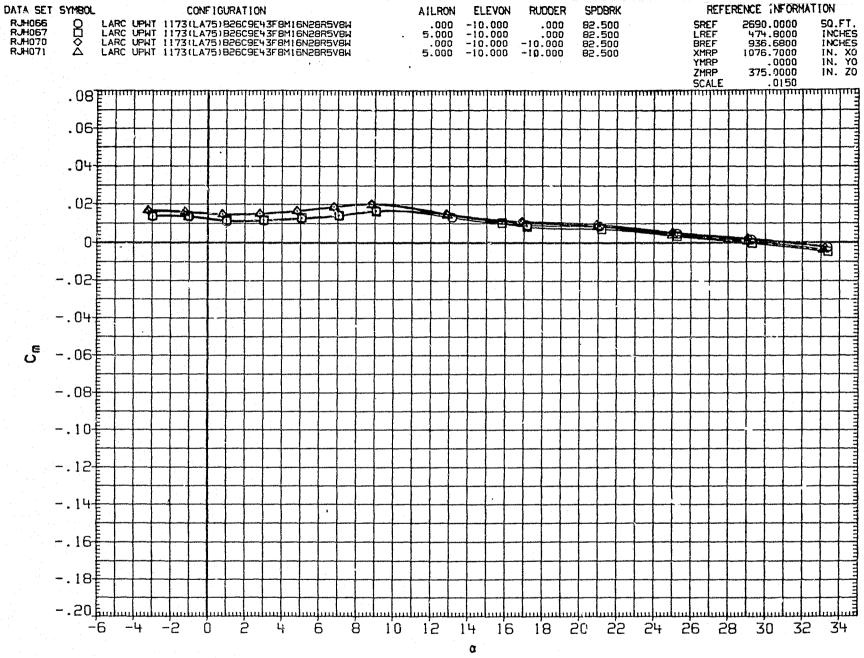


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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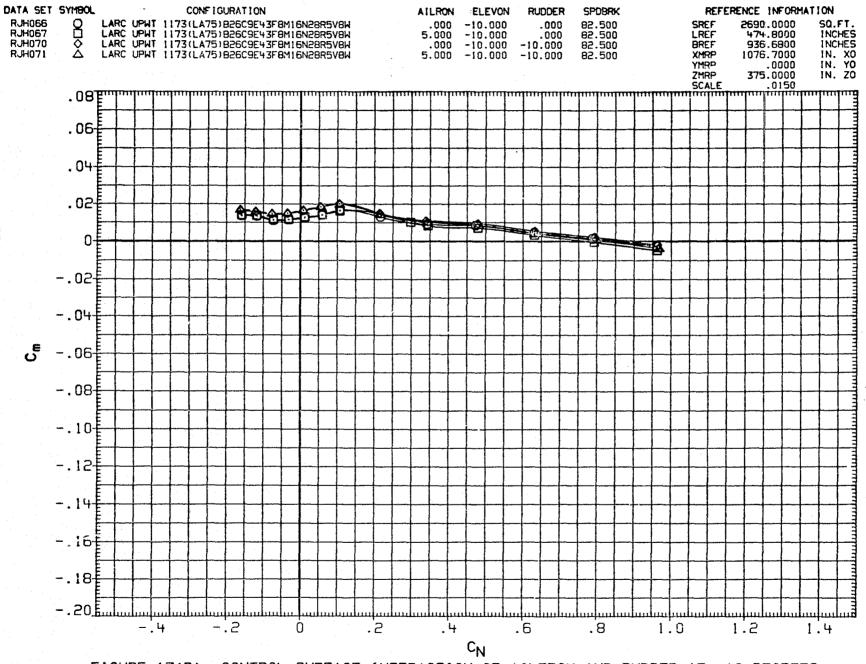


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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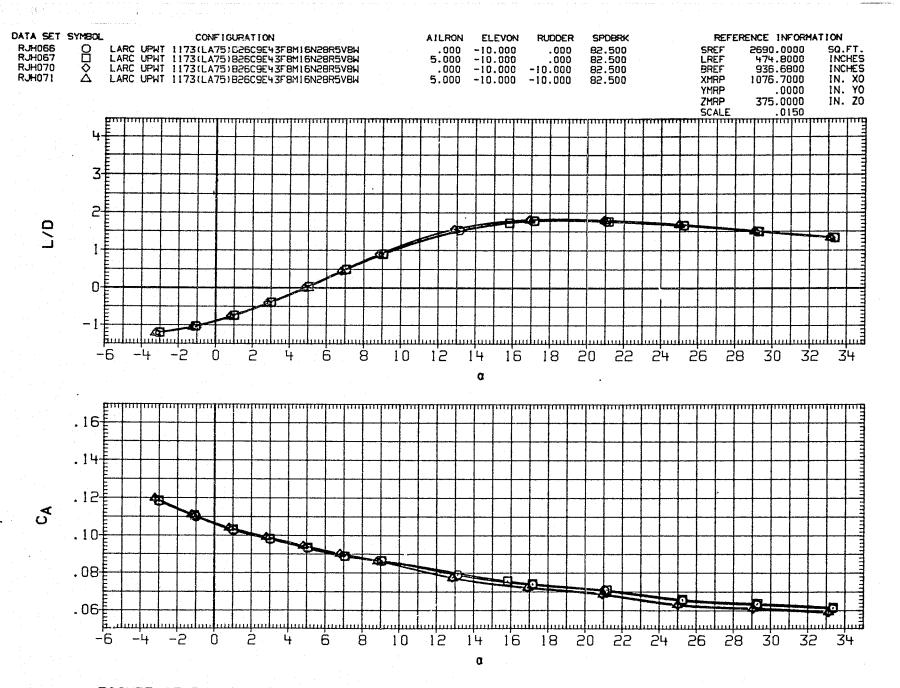


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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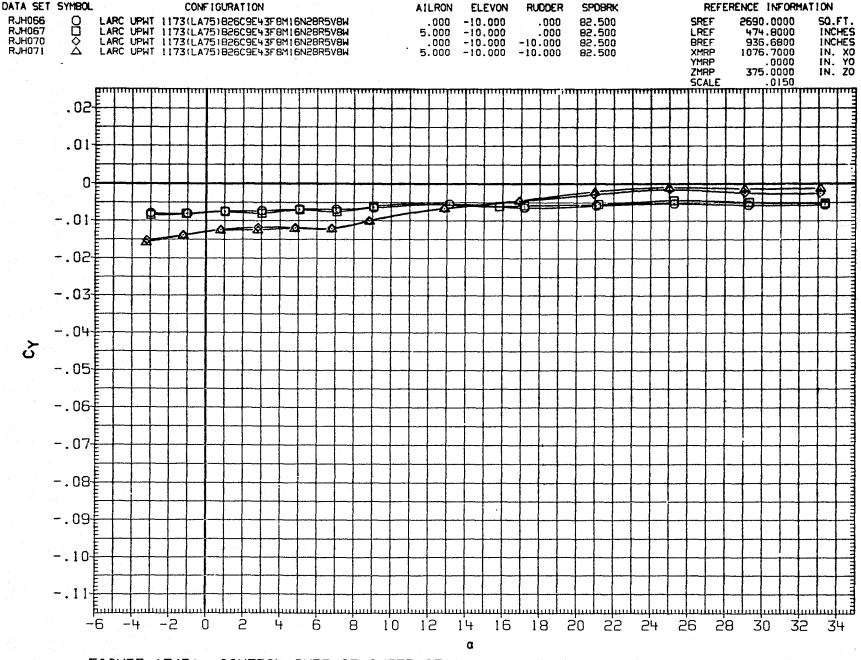
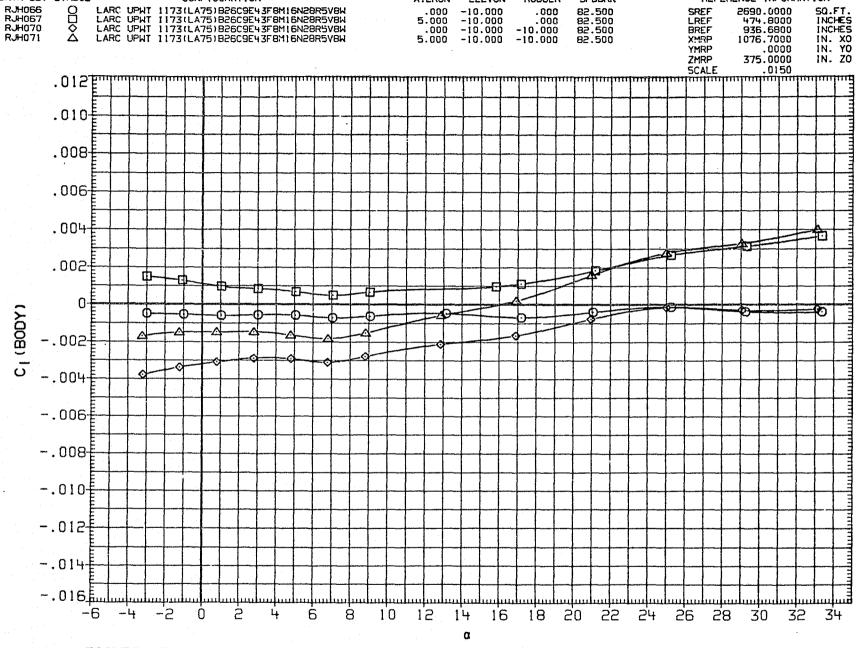


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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AILRON

ELEVON

RUDDER

SPDBRK

REFERENCE INFORMATION

DATA SET SYMBOL

CONFIGURATION

FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.
PAGE 482

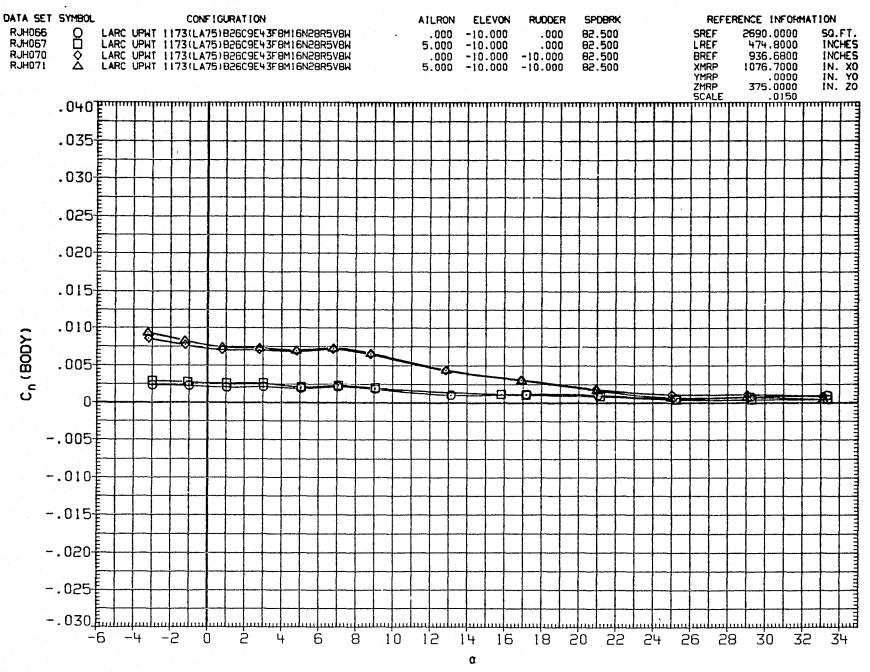


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60

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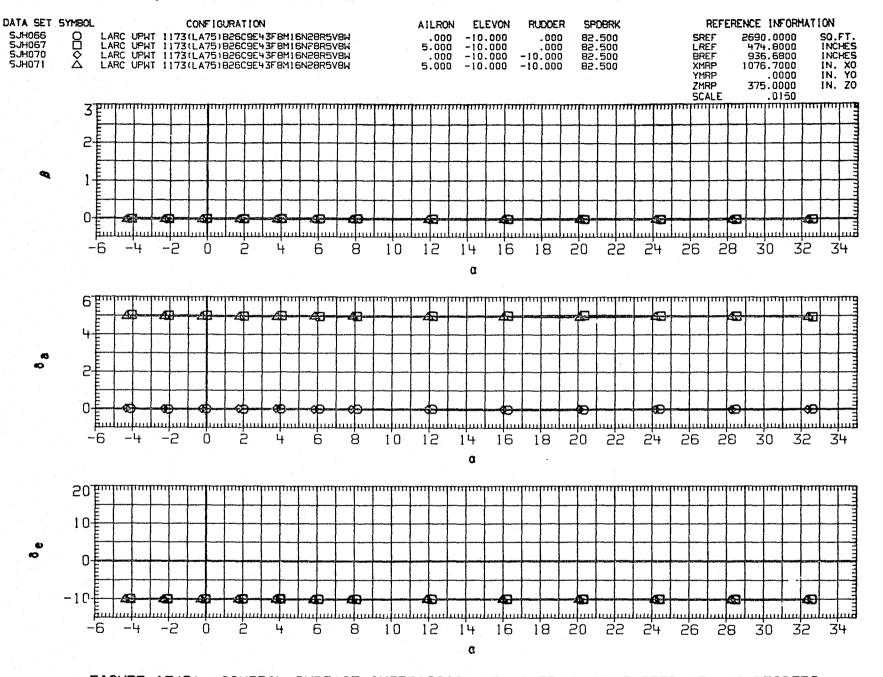


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(A) MACH = 2.86

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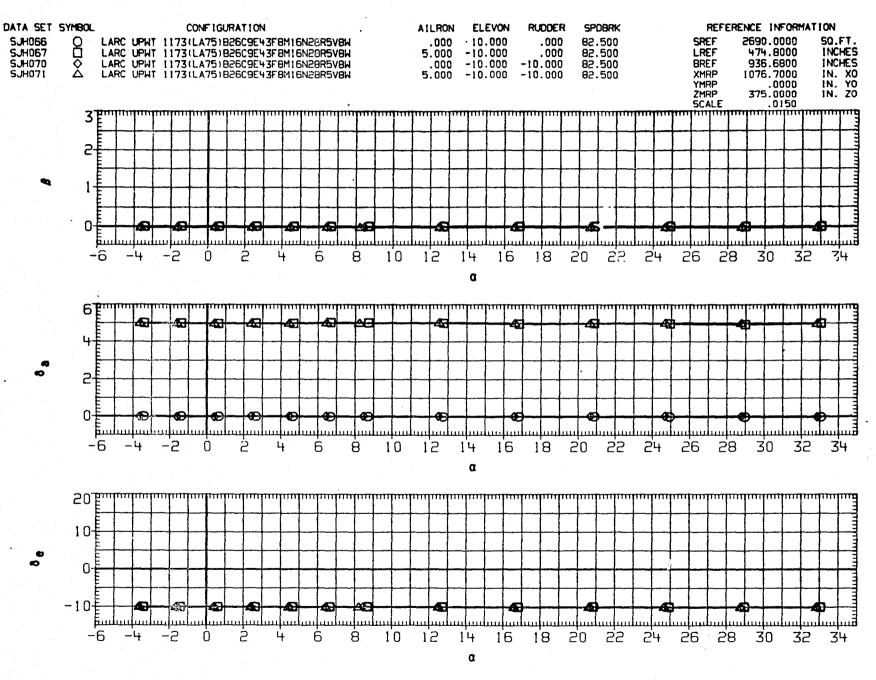


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES
TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
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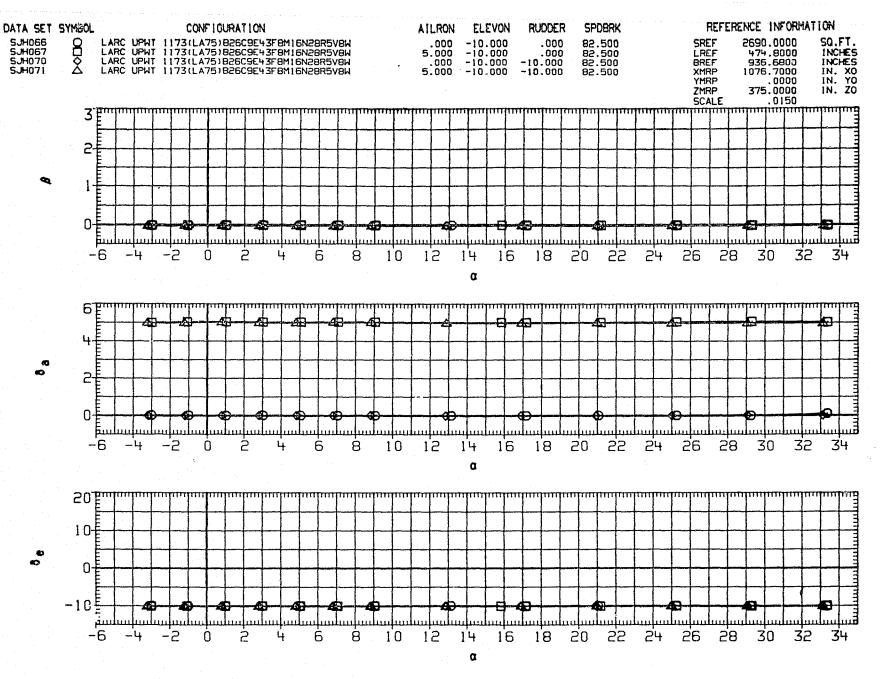


FIGURE 13(D). CONTROL SURFACE INTERACTION OF AILERON AND RUDDER AT -10 DEGREES

TRIM ELEVON, SPEED BRAKE AT 82.5 DEG.

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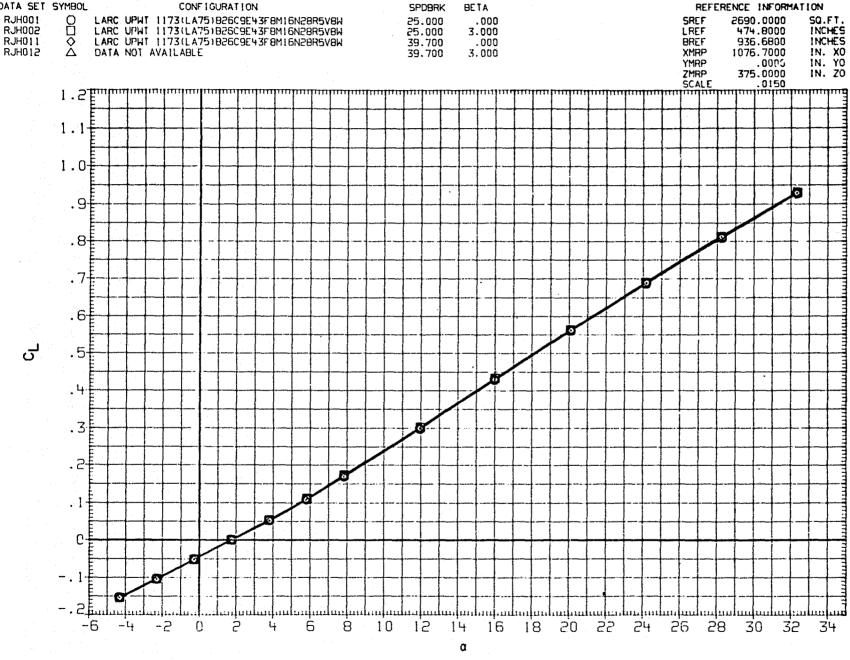


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

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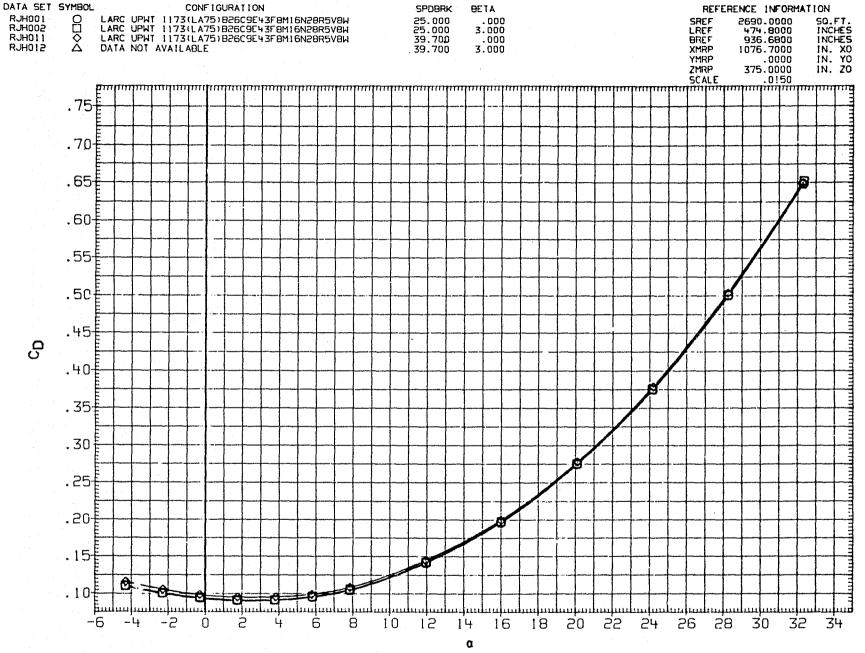


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

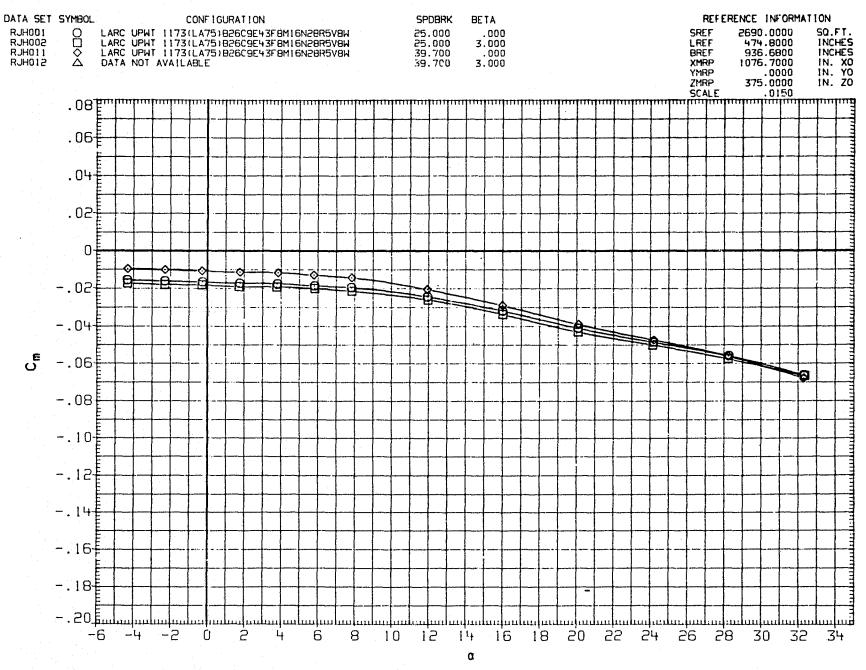


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

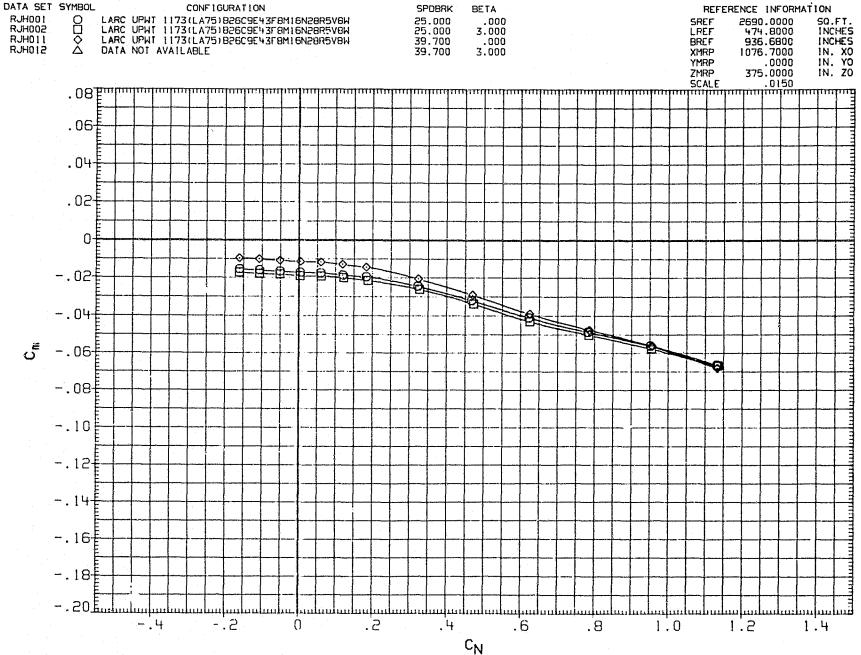


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

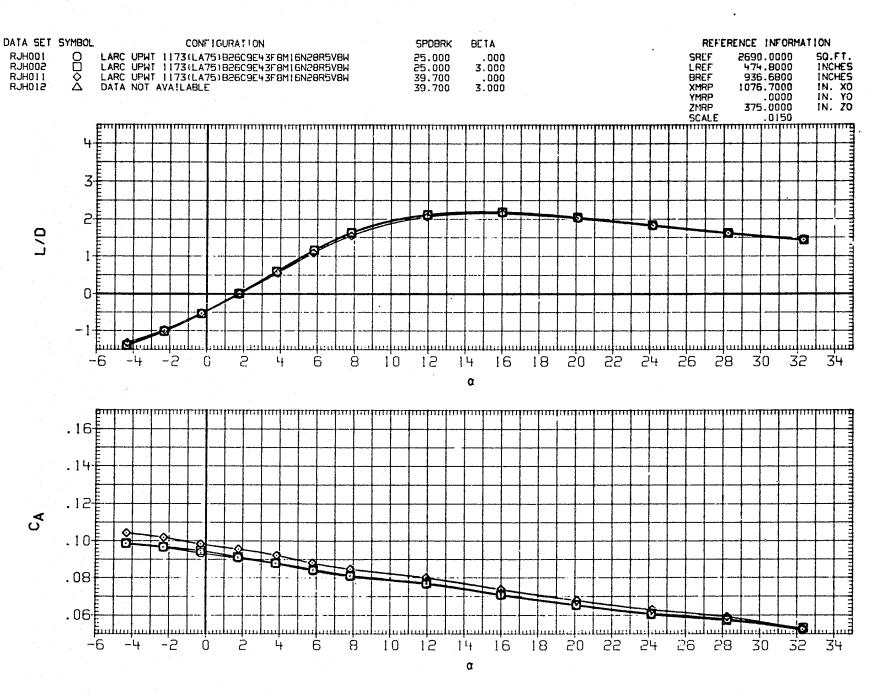


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

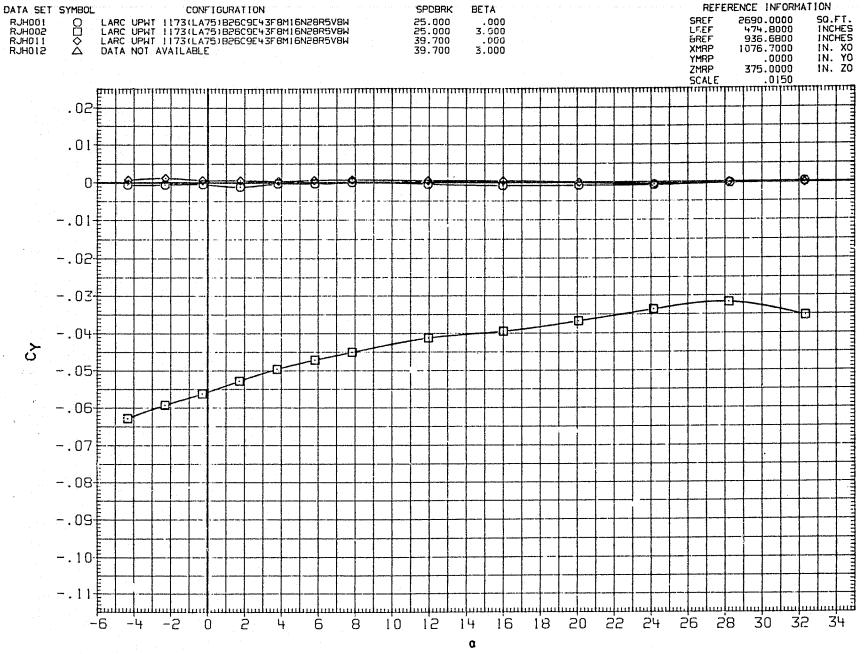


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

(A)MACH = 2.86

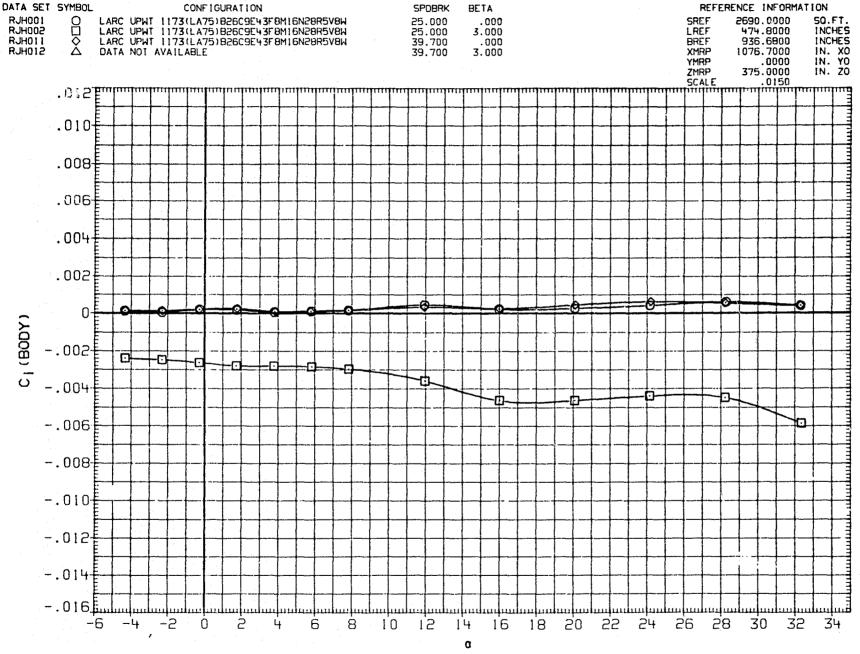


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

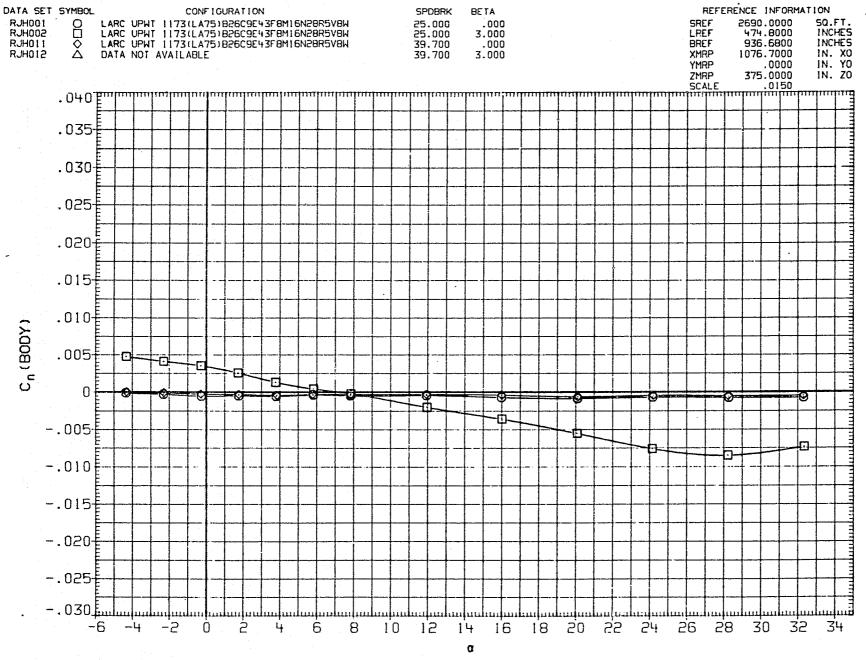


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

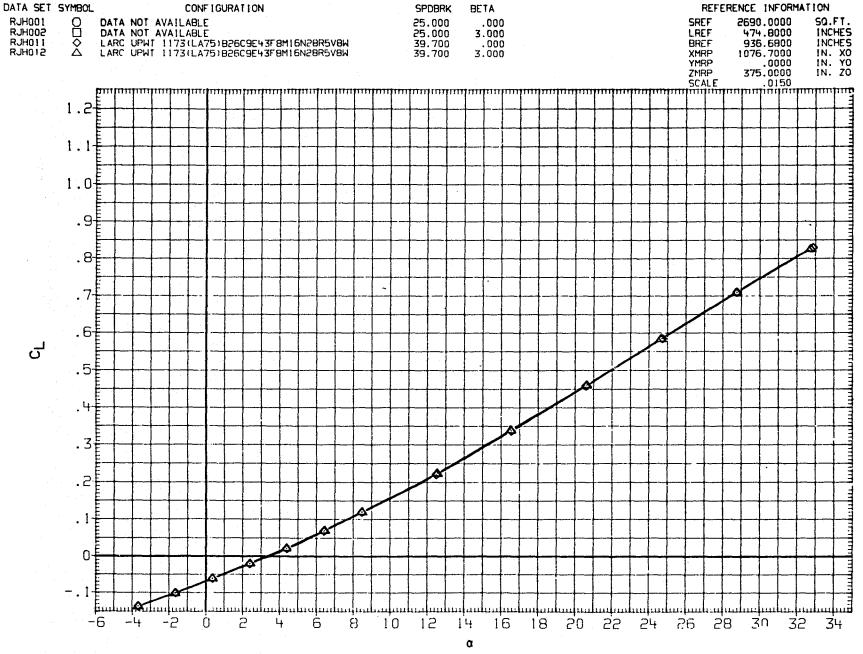


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

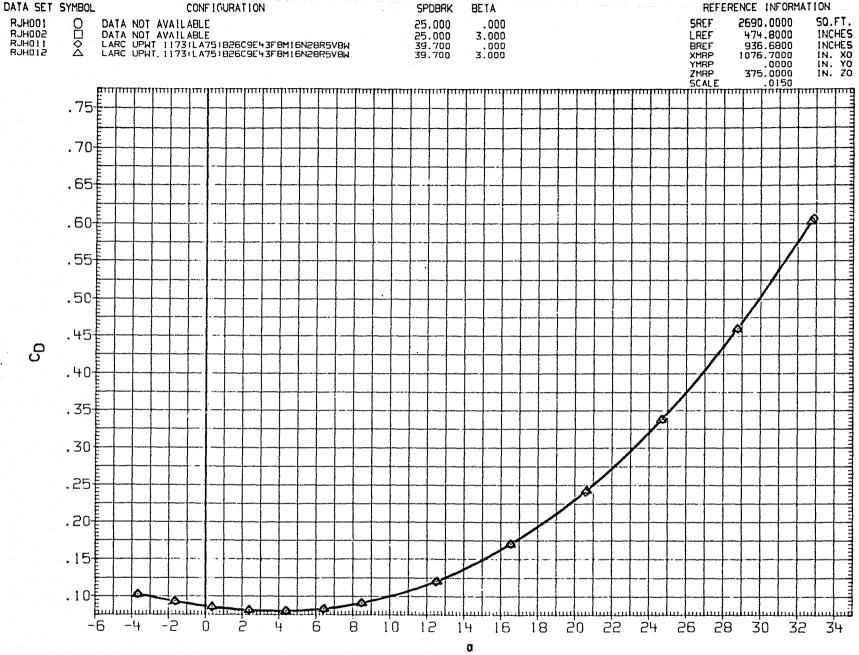


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

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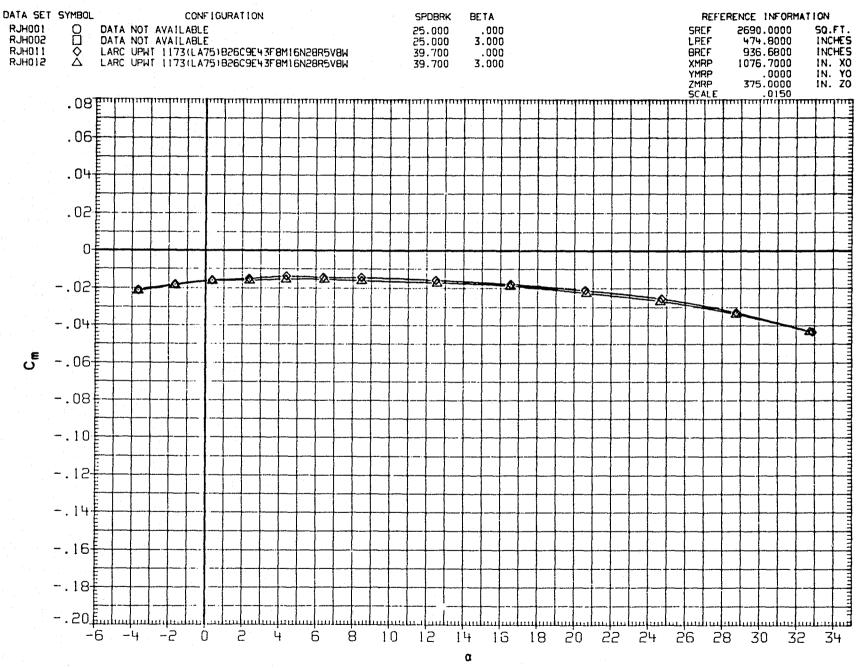


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

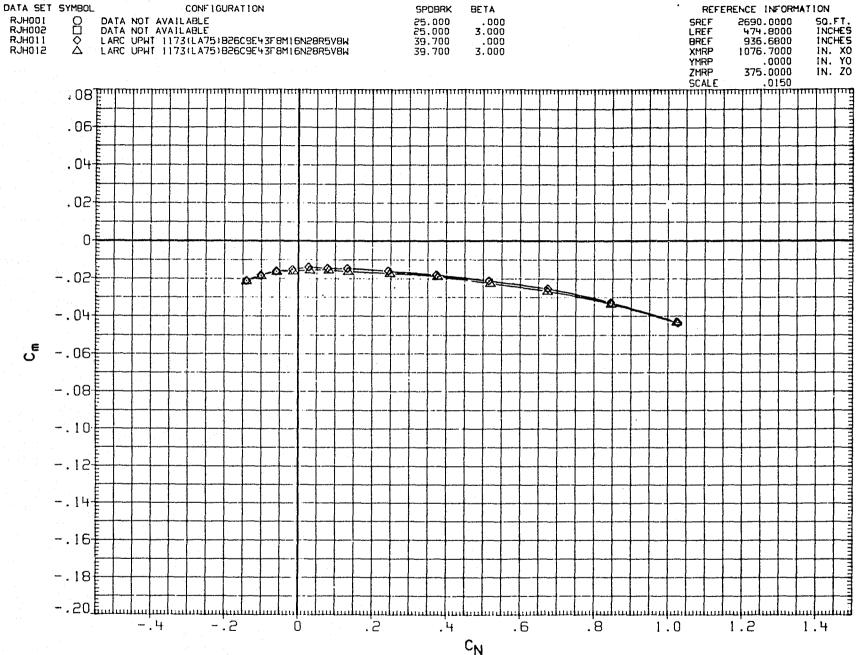


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

PAGE

498

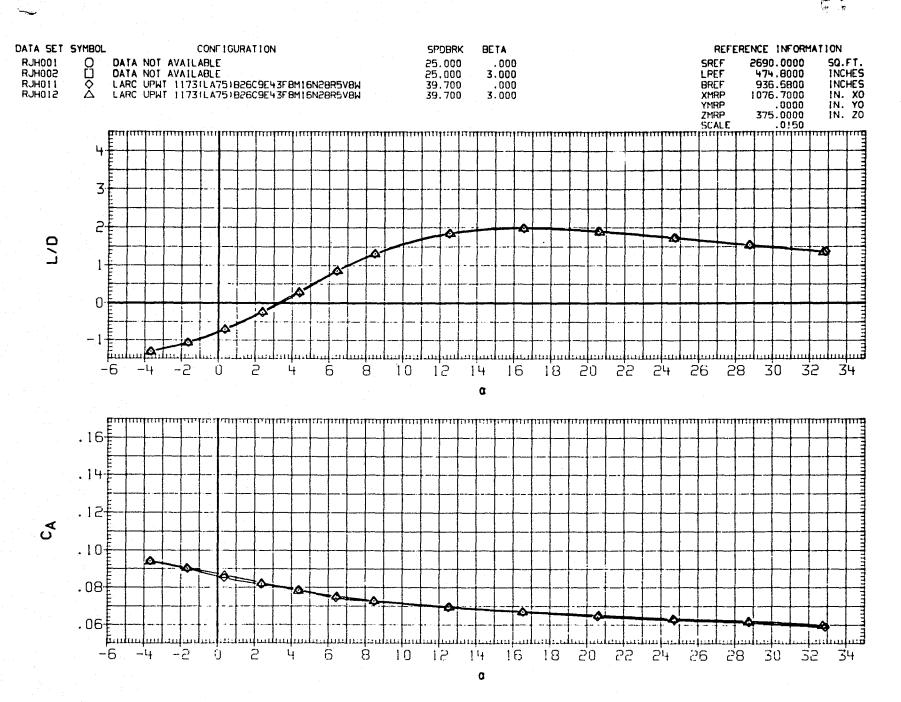


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

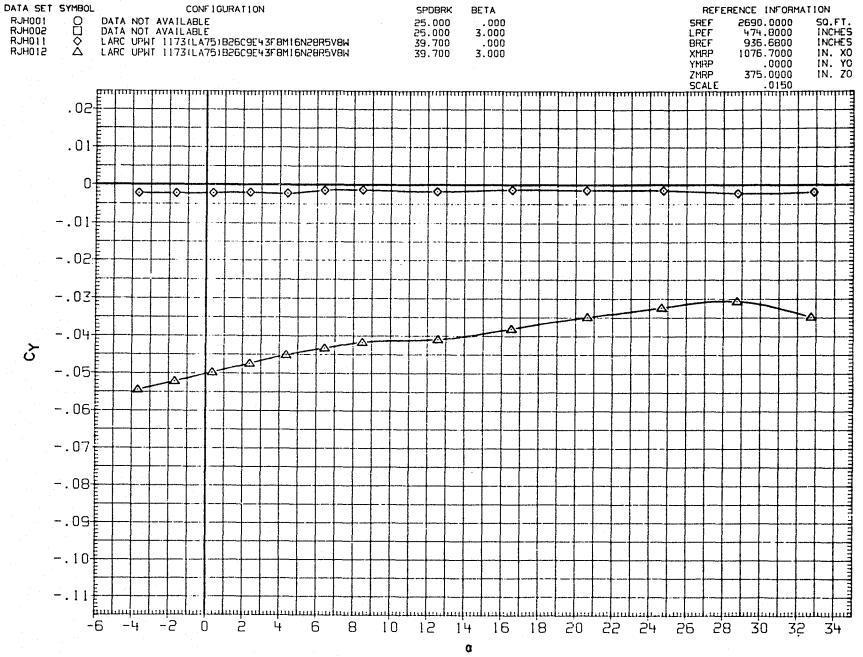


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

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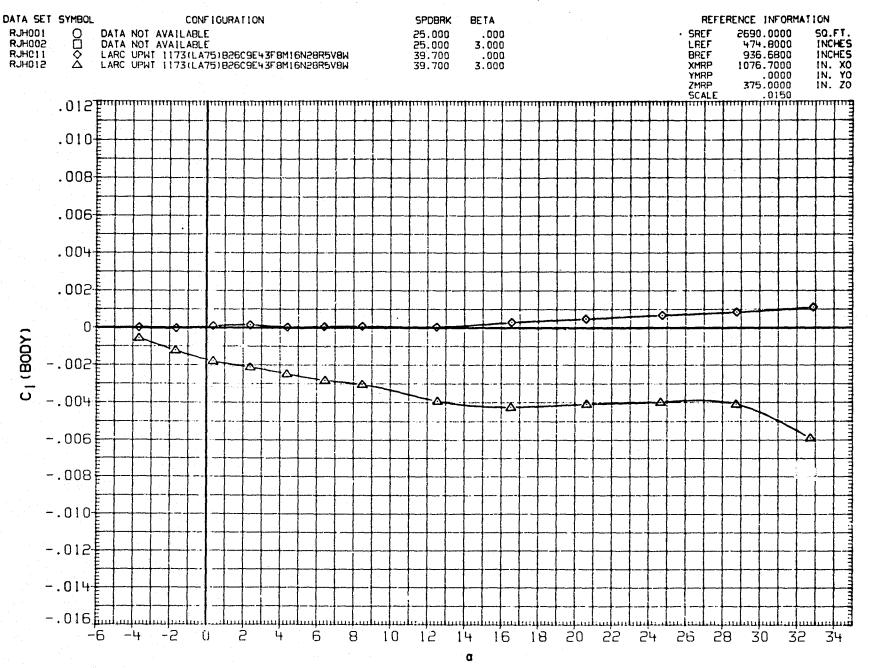


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

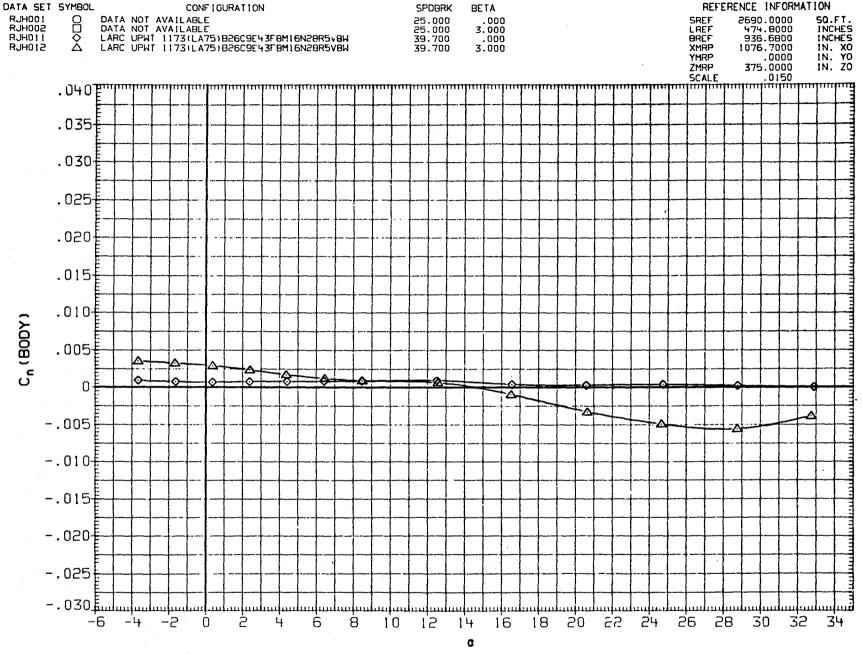


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA



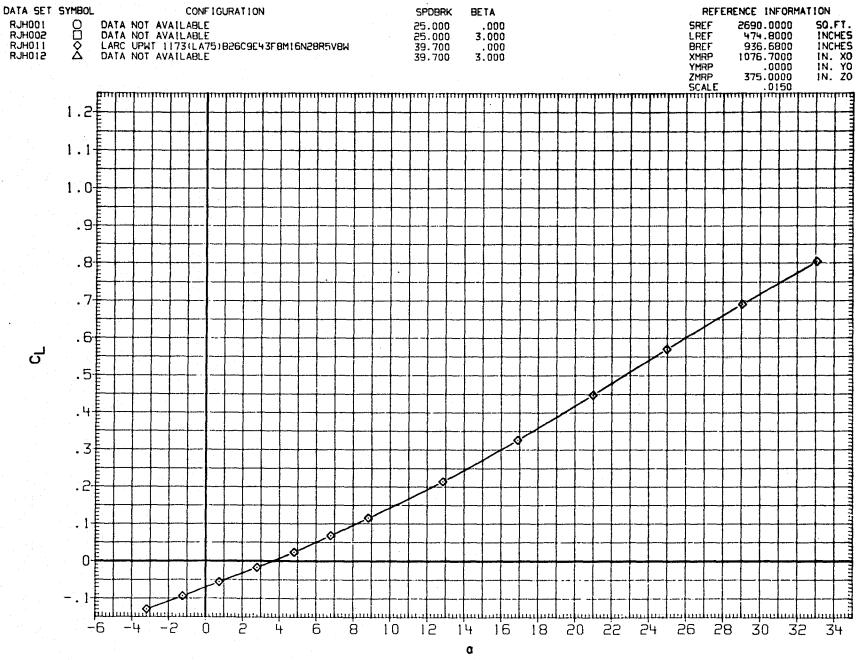
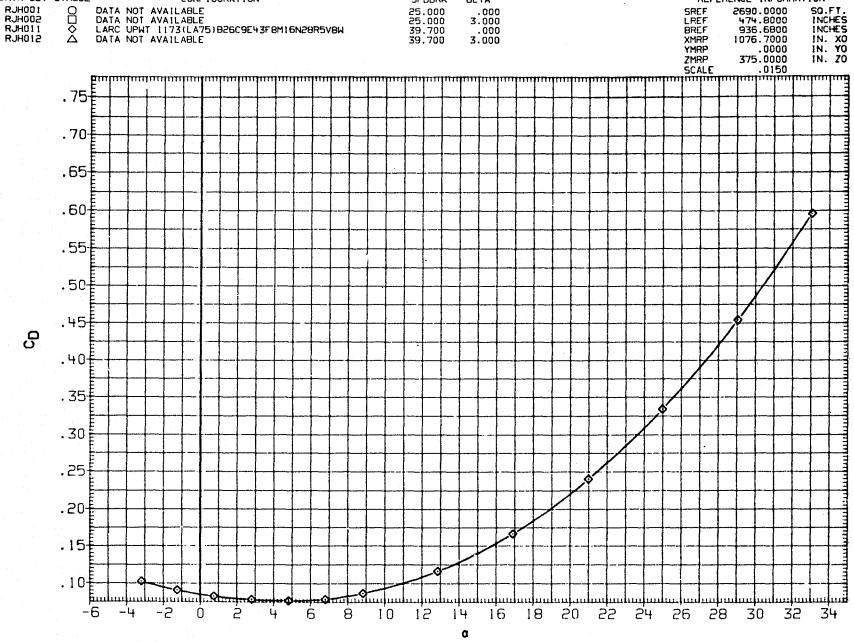


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA



SPDBRK

BETA

FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

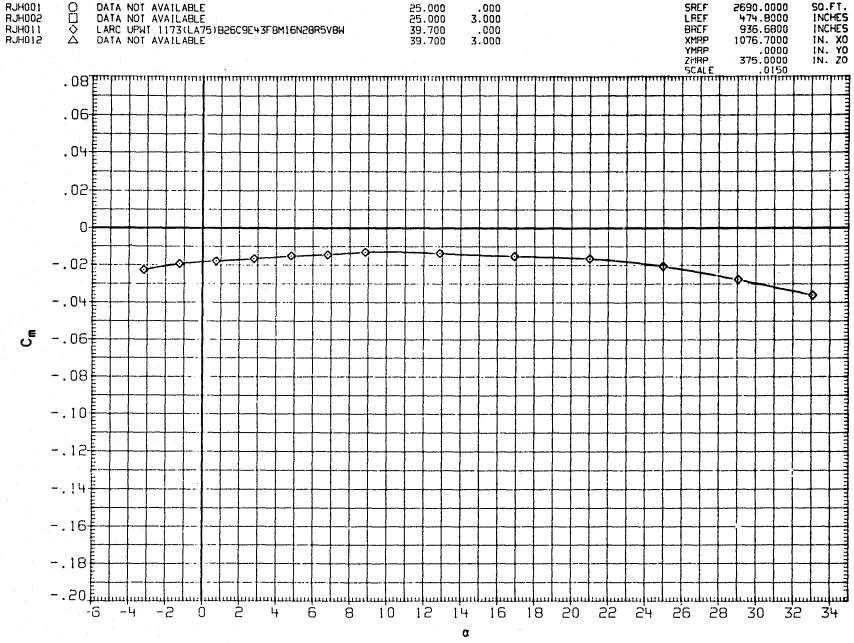
(C)MACH = 4.60

DATA SET SYMBOL

CONFIGURATION

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SPDBRK

BETA

FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

(C)MACH = 4.60

DATA SET SYMBOL

CONFIGURATION

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REFERENCE INFORMATION

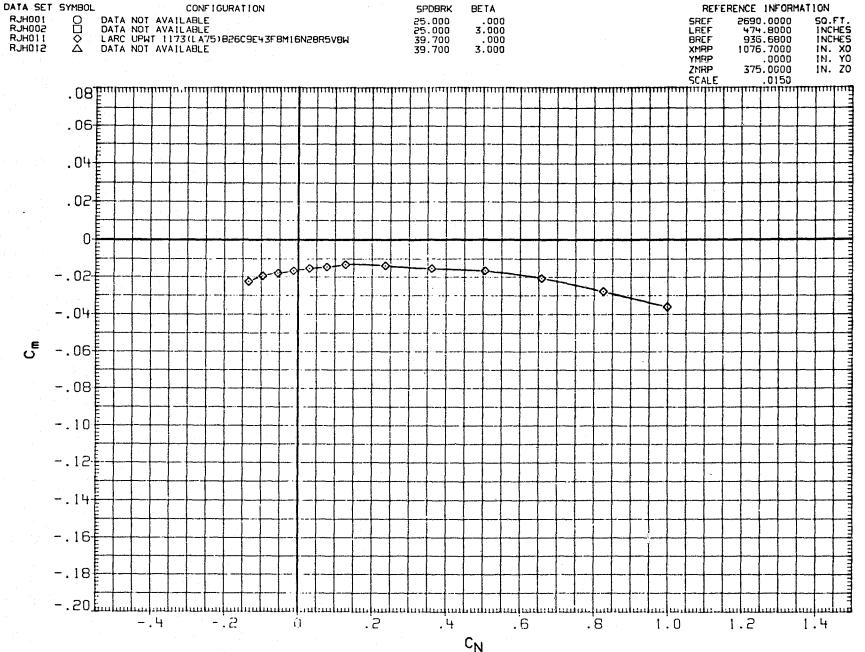


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

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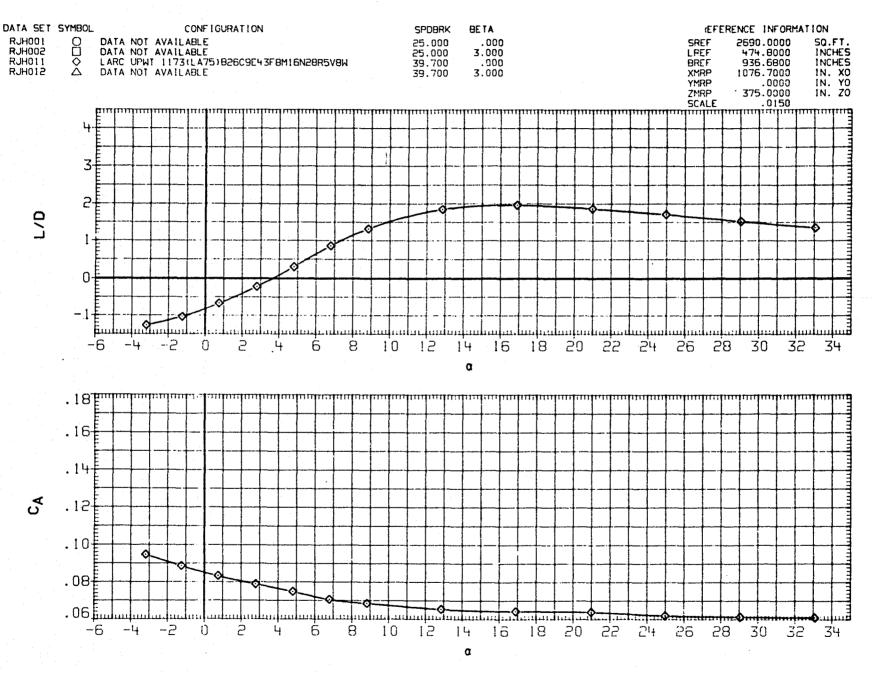
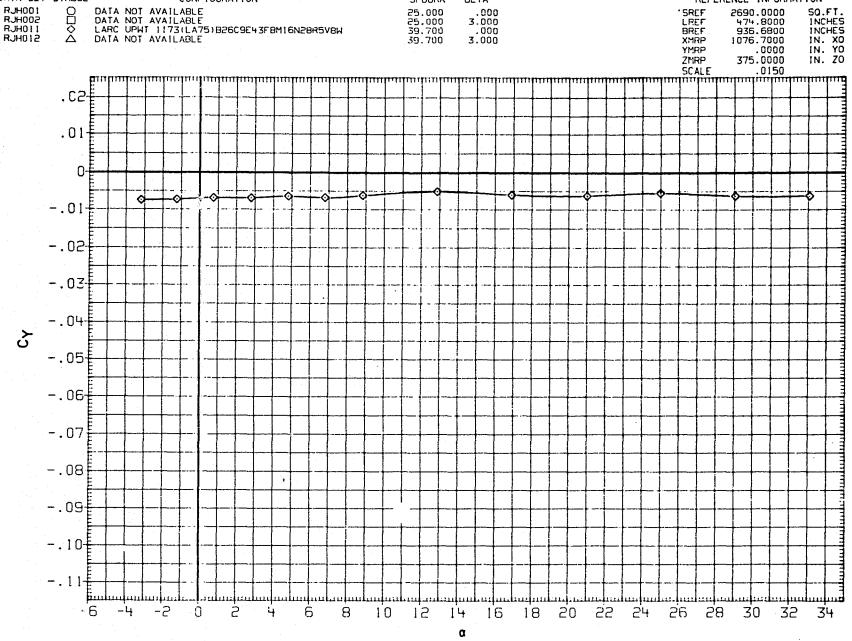


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA



SPDBRK

BETA

FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

(C)MACH = .4.60

DATA SET SYMBOL

CONFIGURATION

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REFERENCE INFORMATION



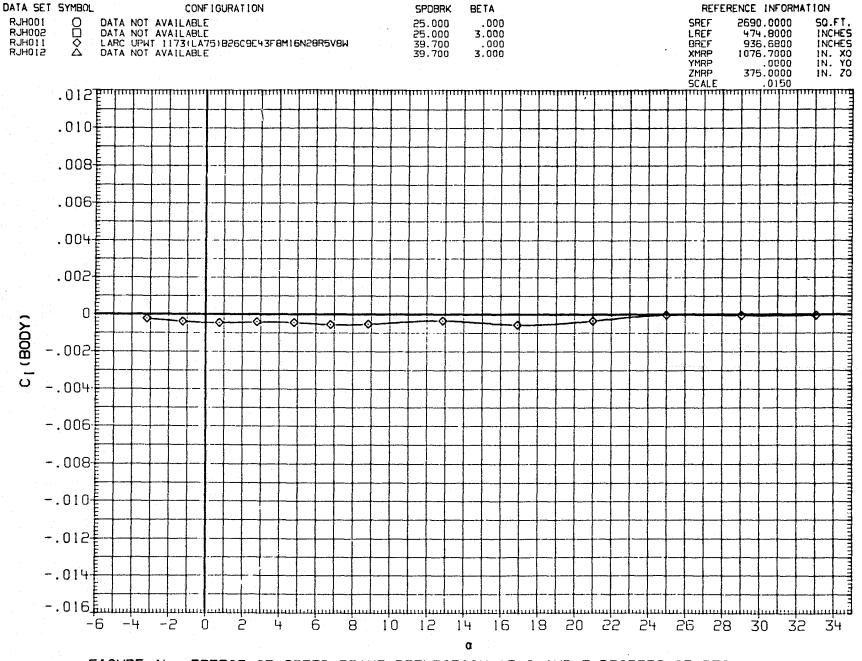


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

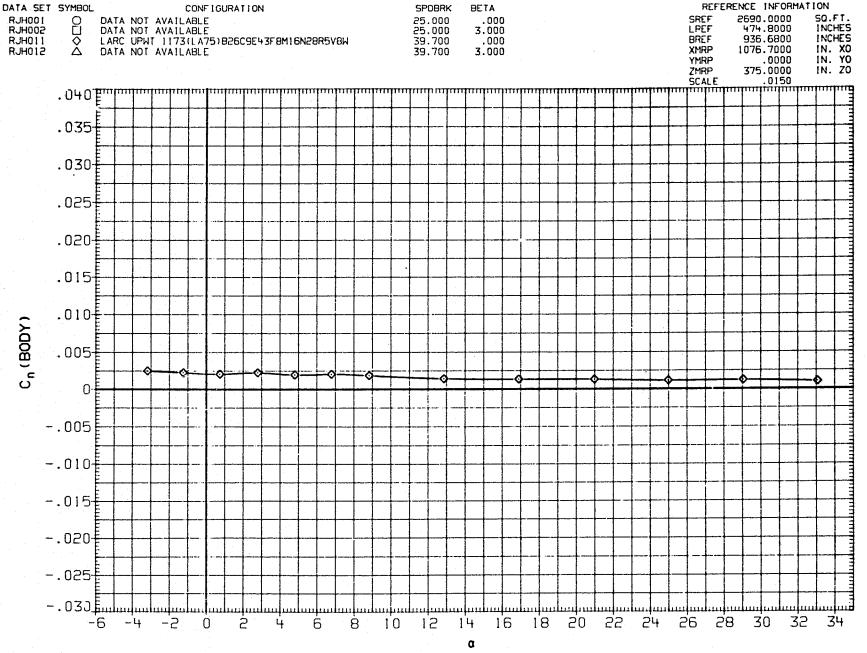


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

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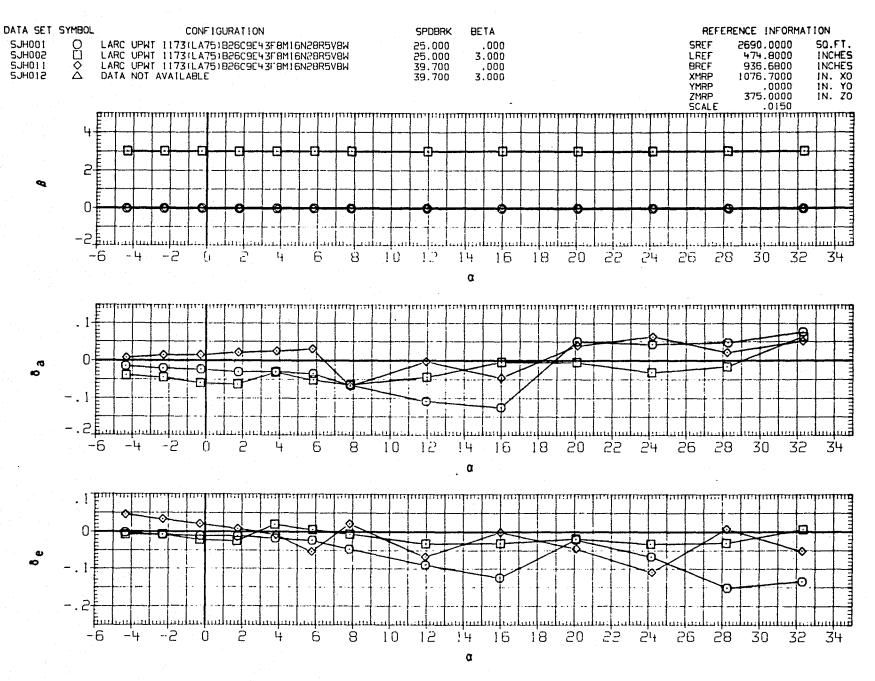


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

(A)MACH = 2.86

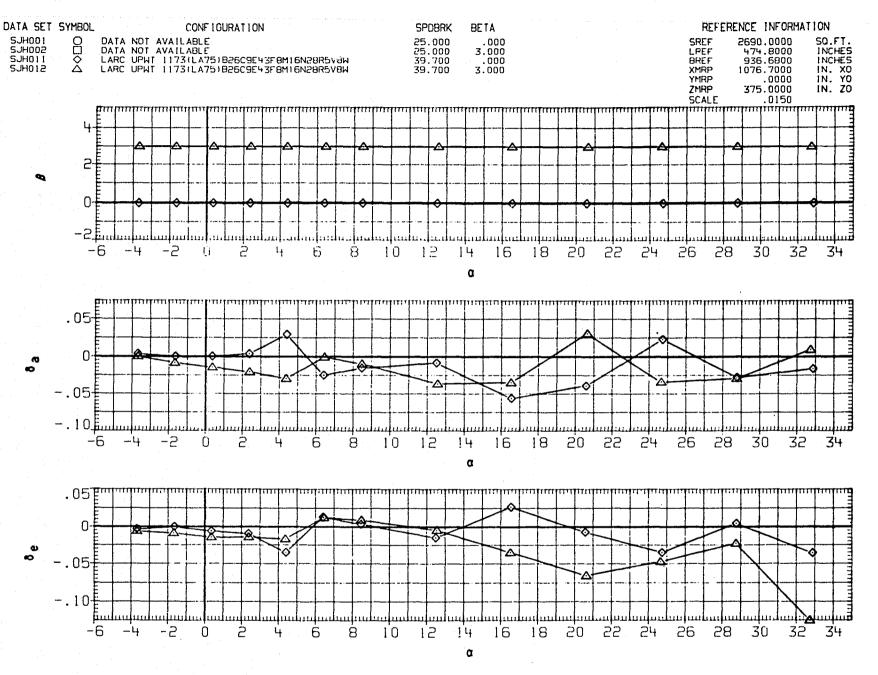


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA



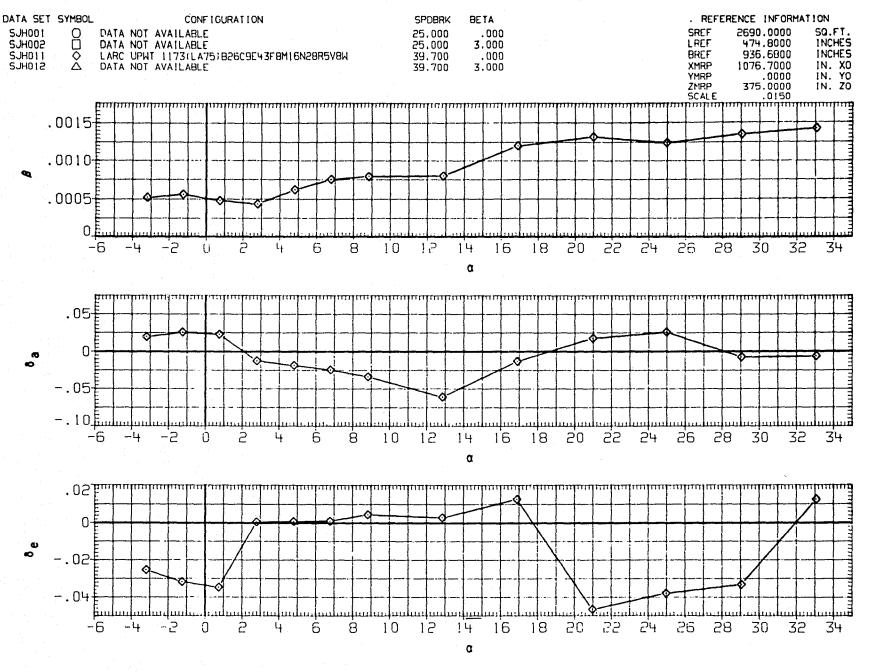


FIGURE 14. EFFECT OF SPEED BRAKE DEFLECTION AT 0 AND 3 DEGREES OF BETA

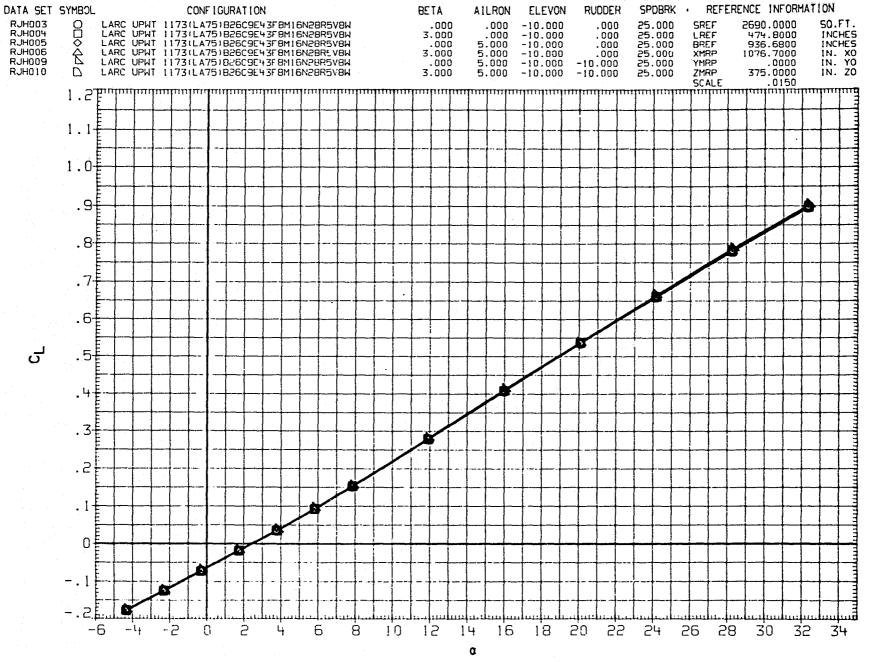


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.

(A) MACH = 2.86
PAGE

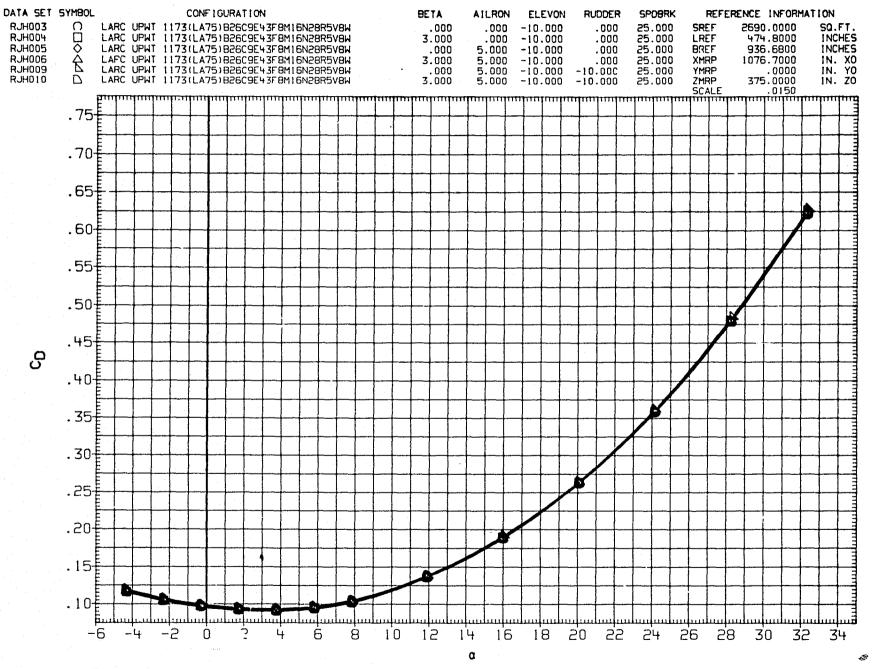


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.

(A) MACH = 2.86
PAGE 515

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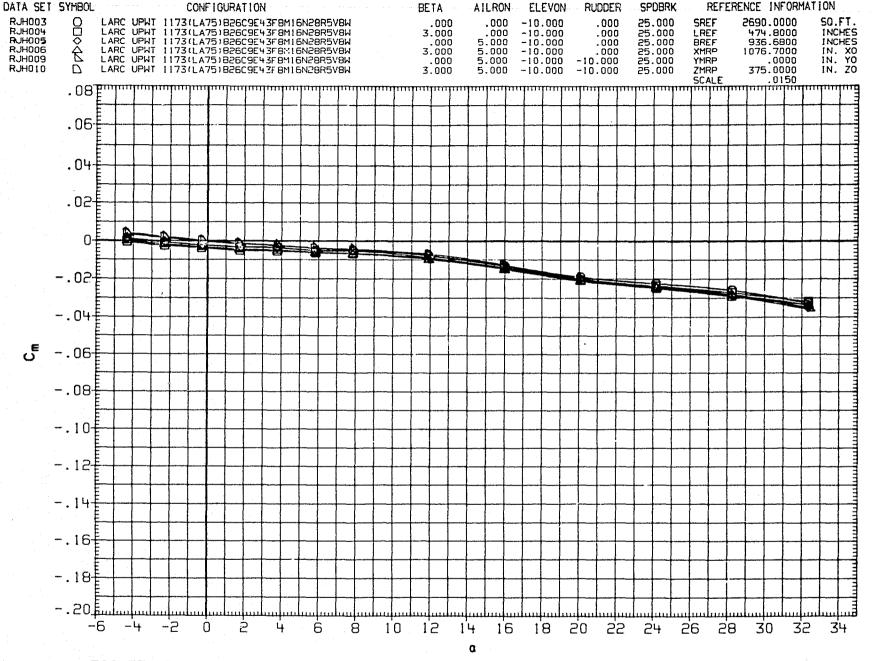


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.
PAGE 516

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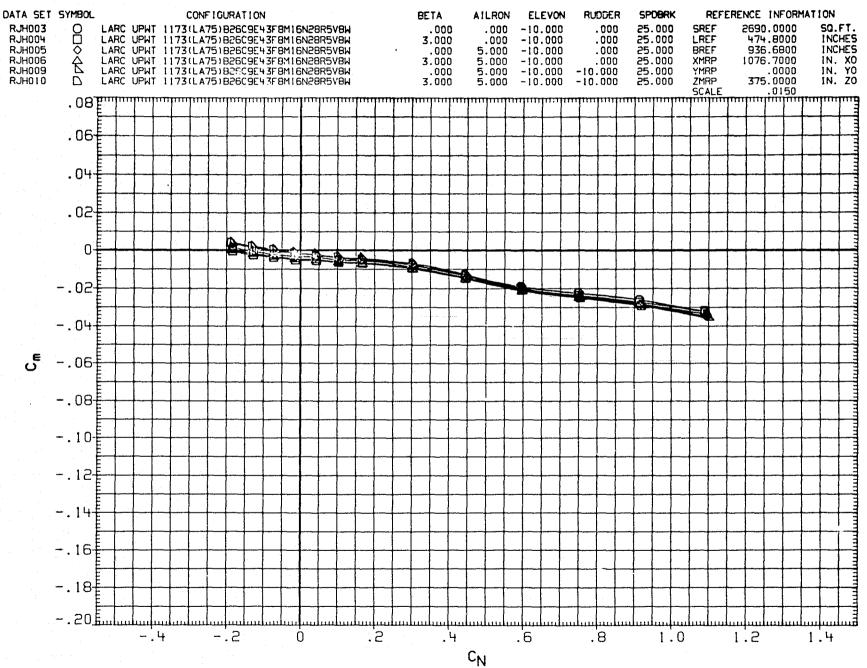


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.

(A) MACH = 2.86
PAGE

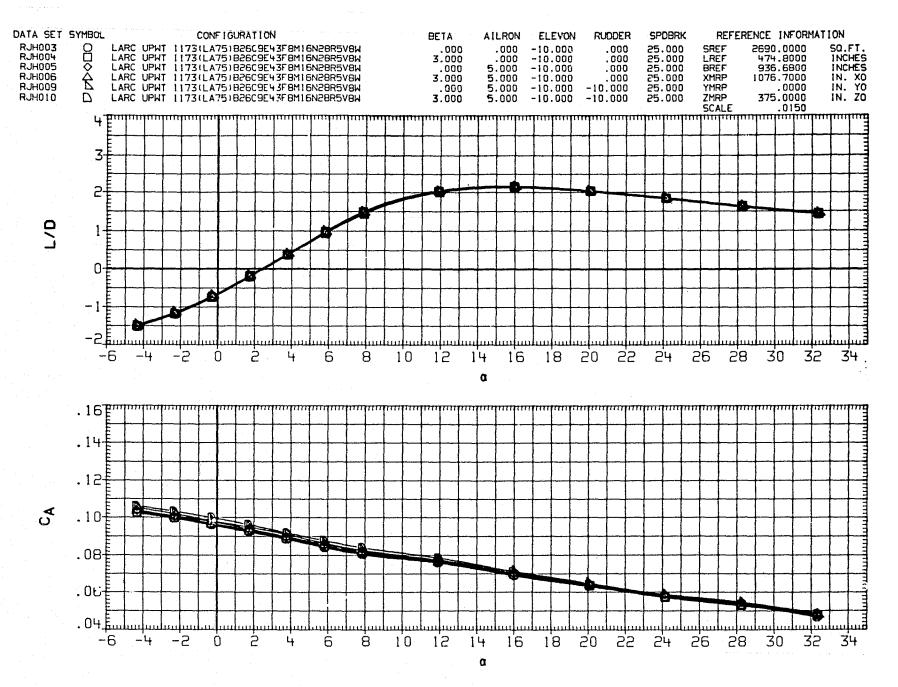


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.
PAGE 518

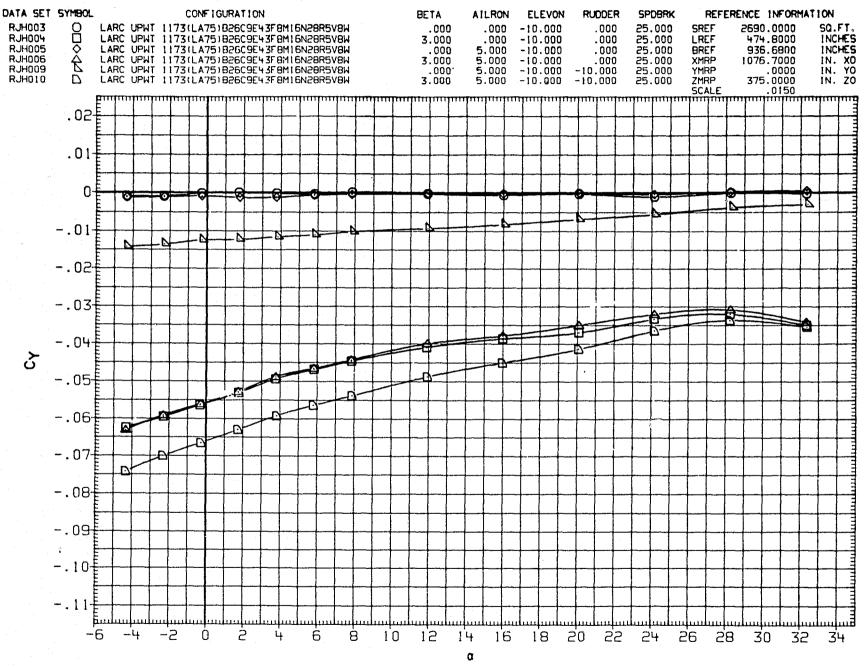


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.

(A) MACH = 2.86
PAG

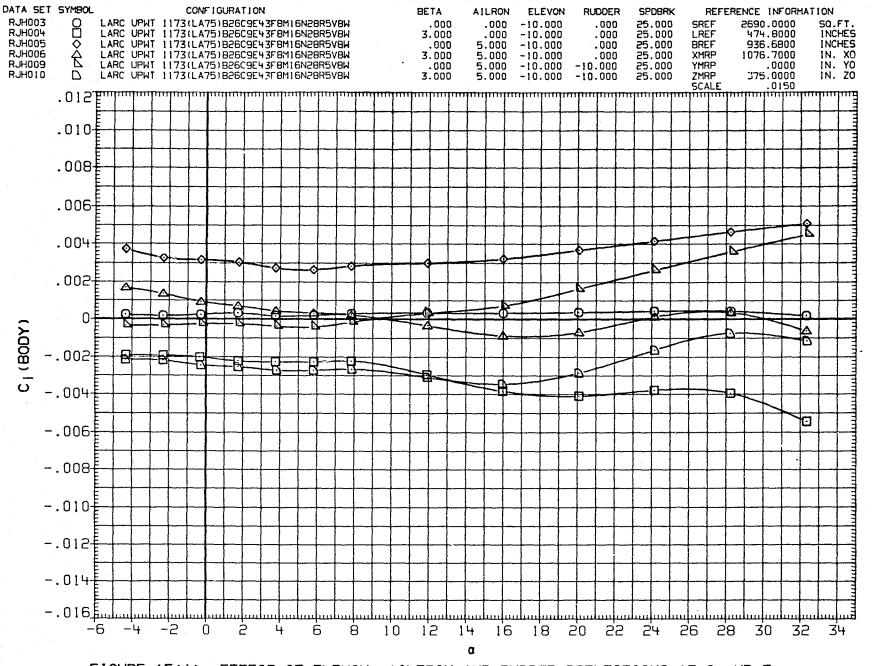


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.
PAGE 520

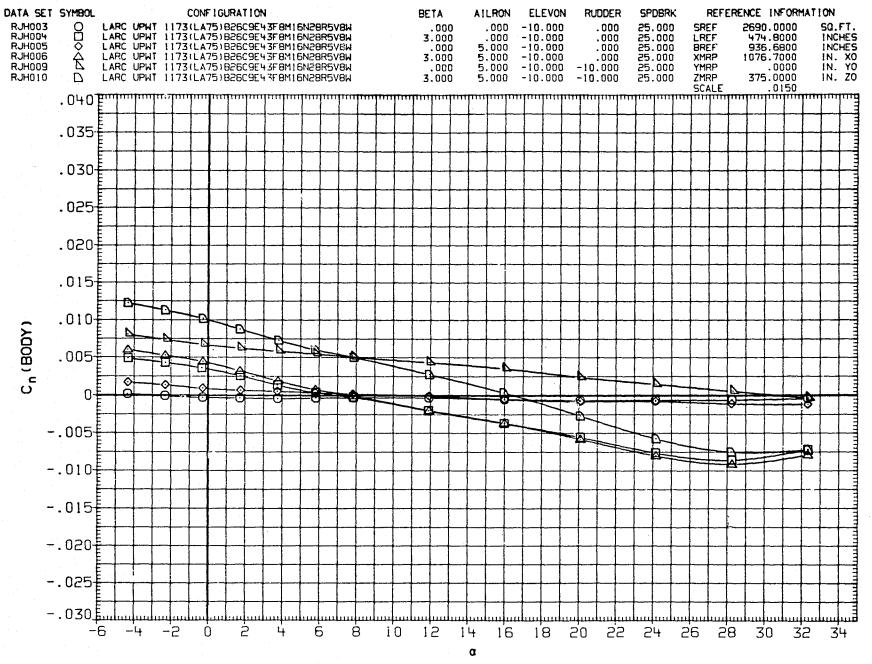


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.

(A) MACH = 2.86
PAGE

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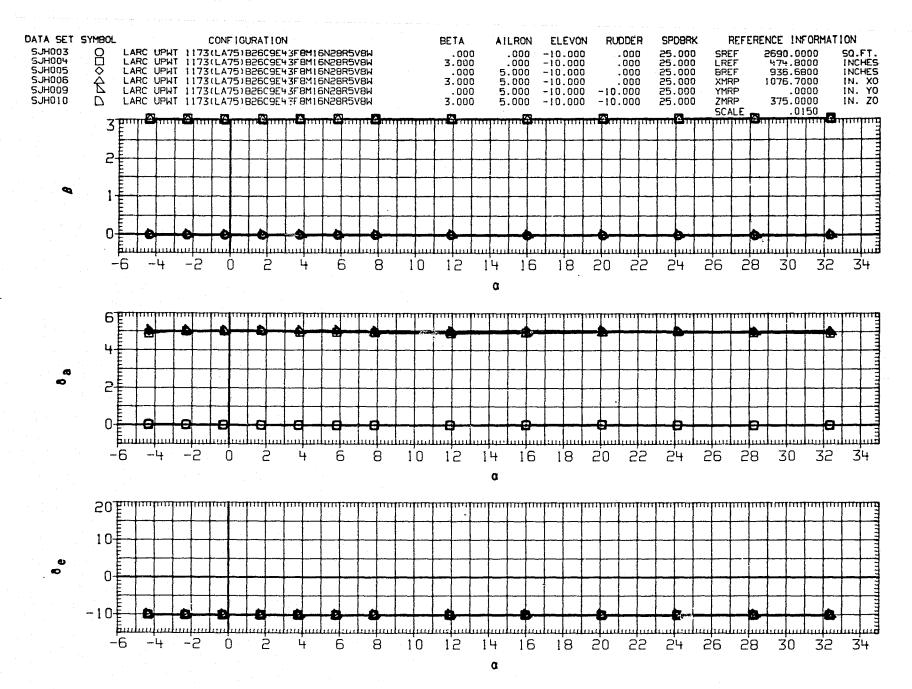


FIGURE 15(A). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 25.0 DEG.
PAGE 522



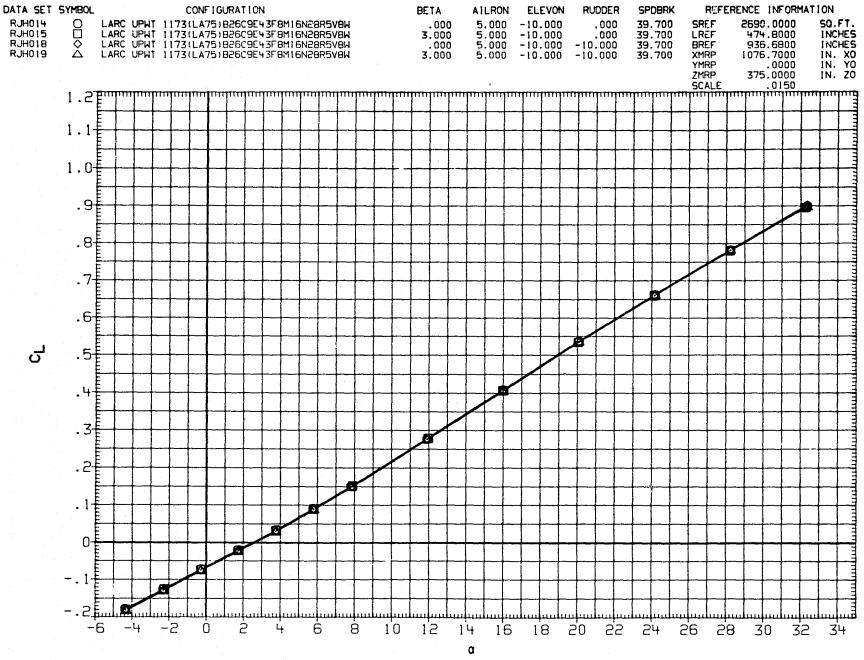


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86
PAG

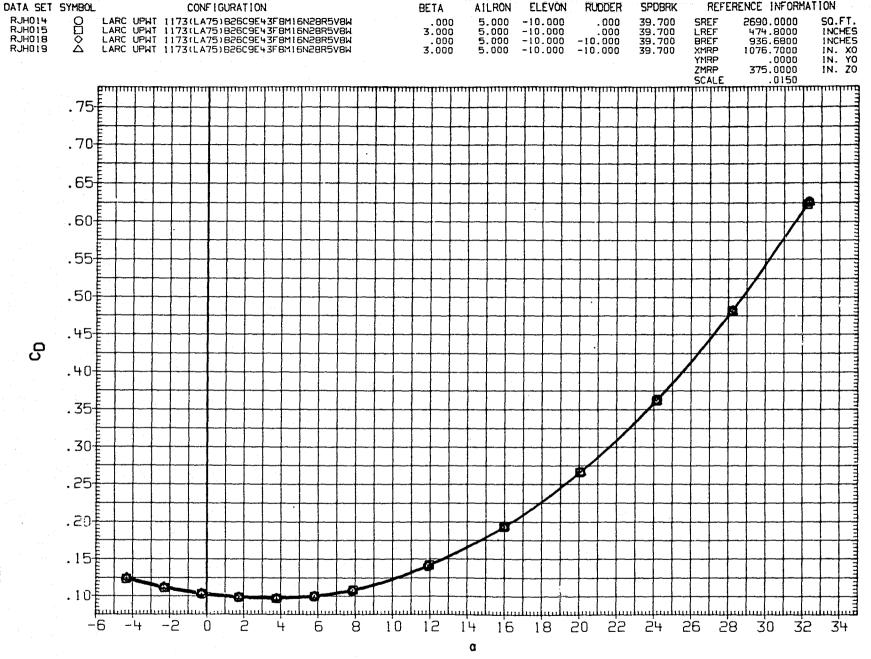


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 524



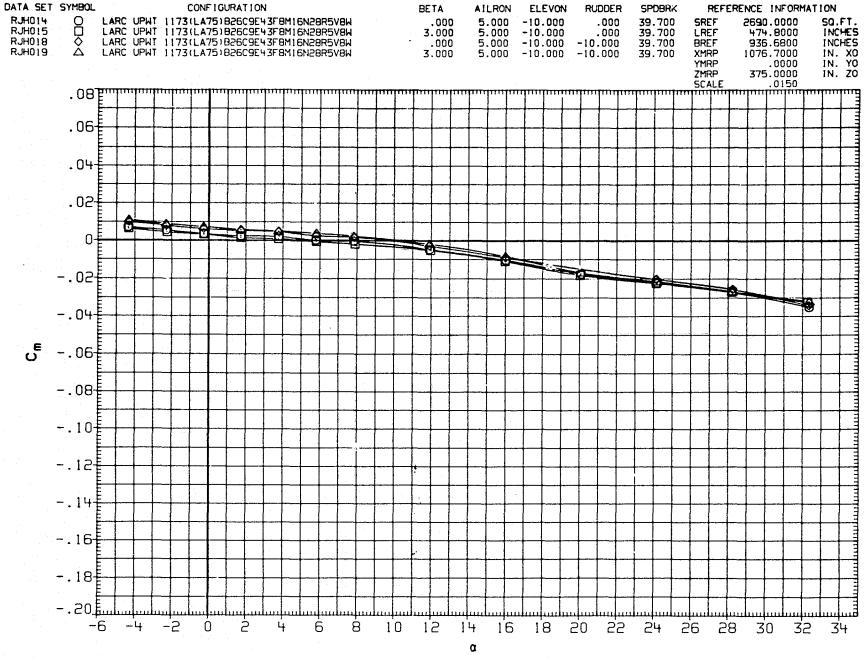
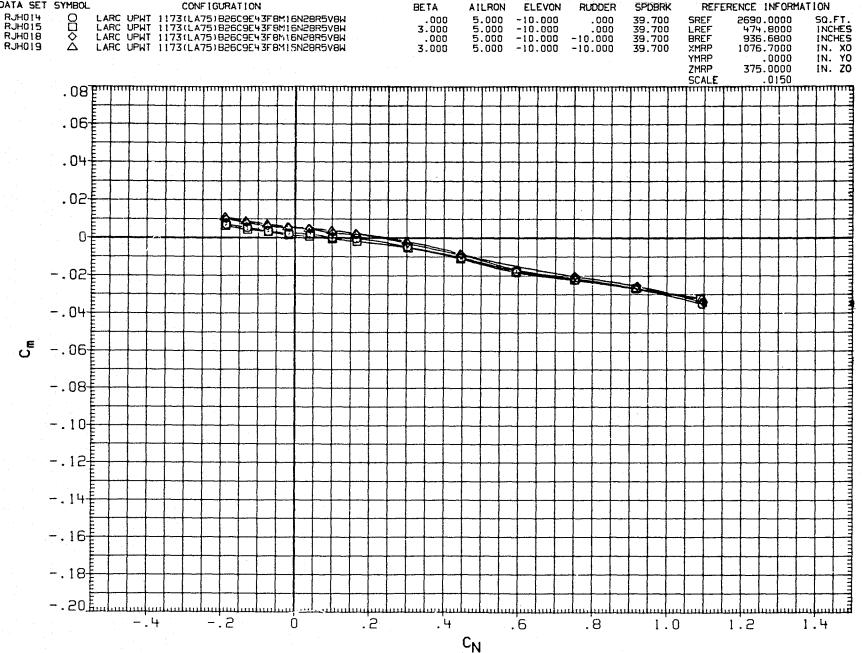


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF SETA, SPEED BRAKE AT 39.7 DEG.

2.86 (A) MACH



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FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG. (A)MACH =2.86 PAGE

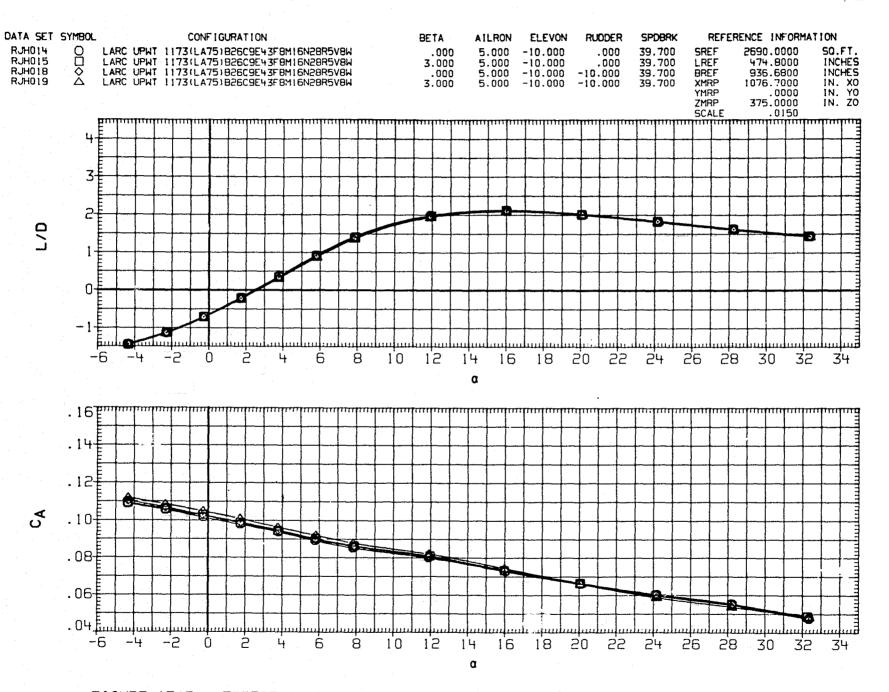


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86
PAGE

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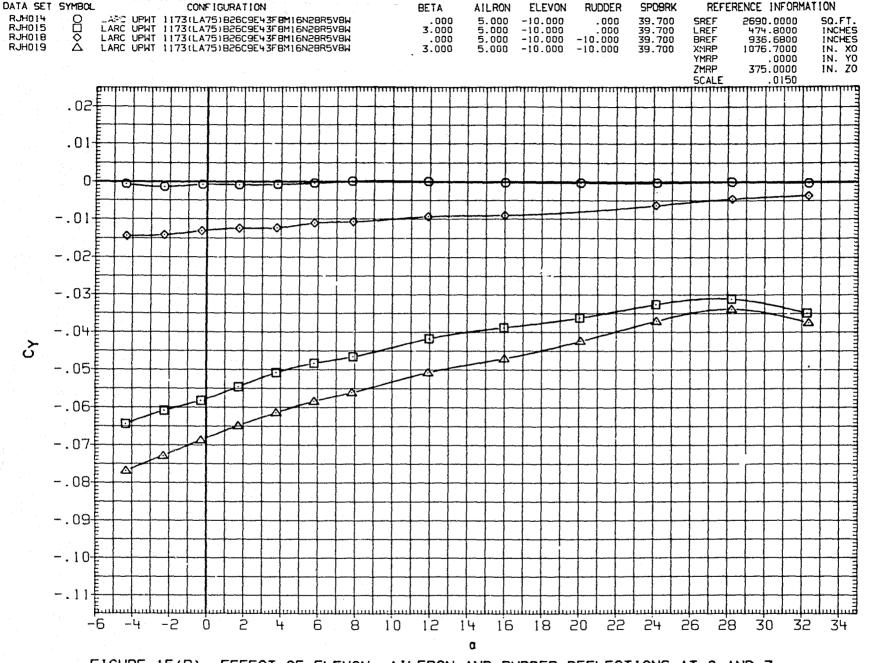


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 528

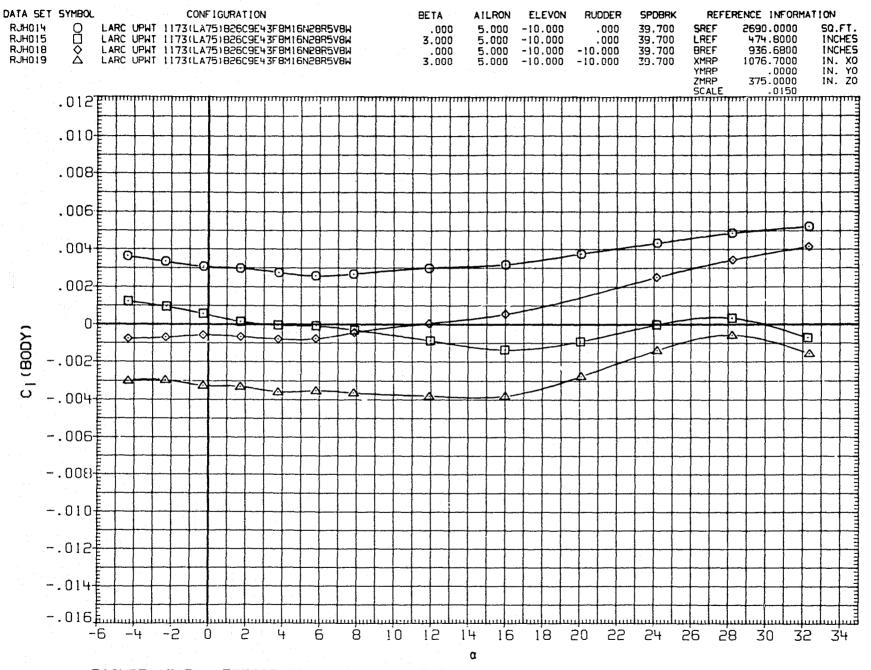


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86
PAGE

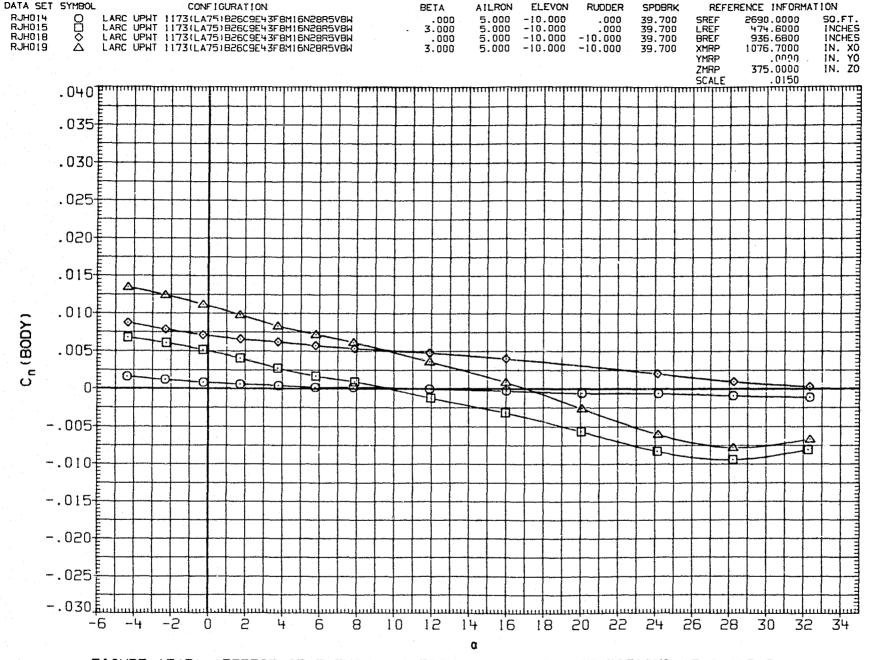


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE

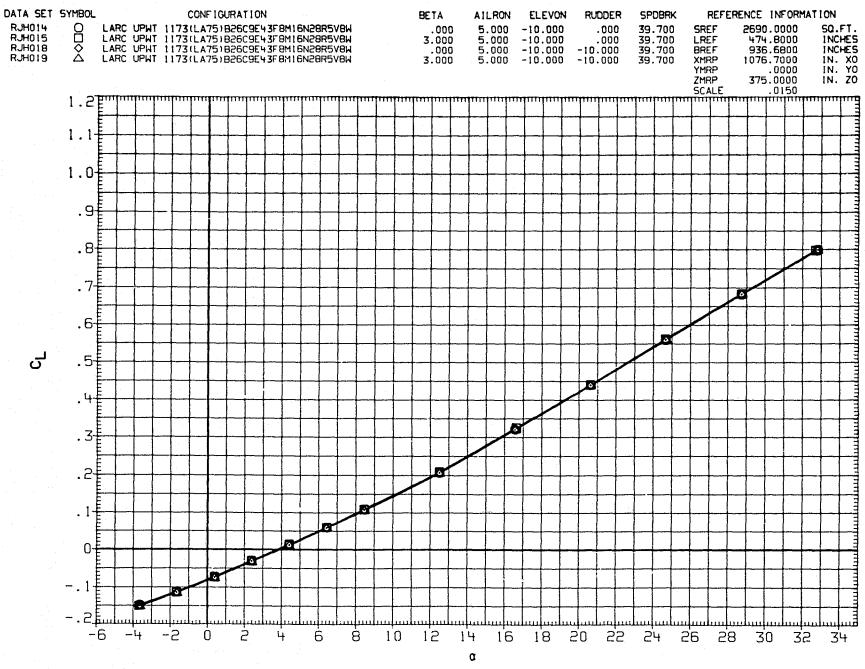


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE

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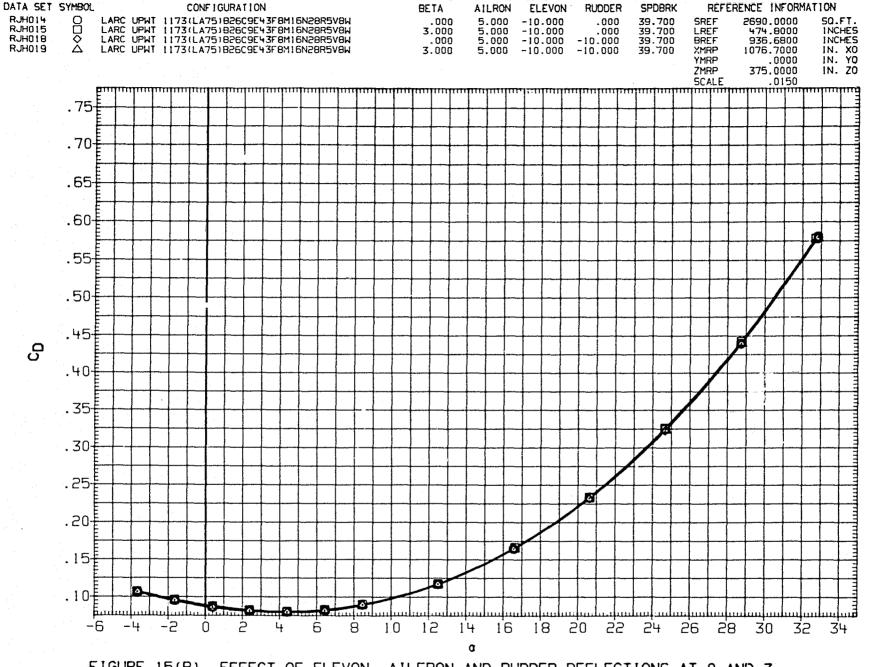


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 532

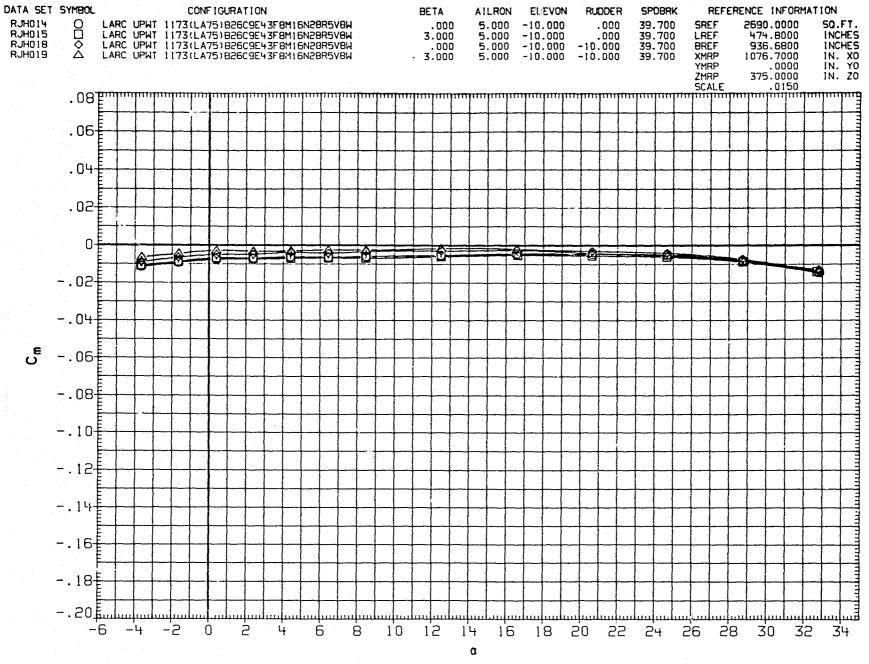


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE 533

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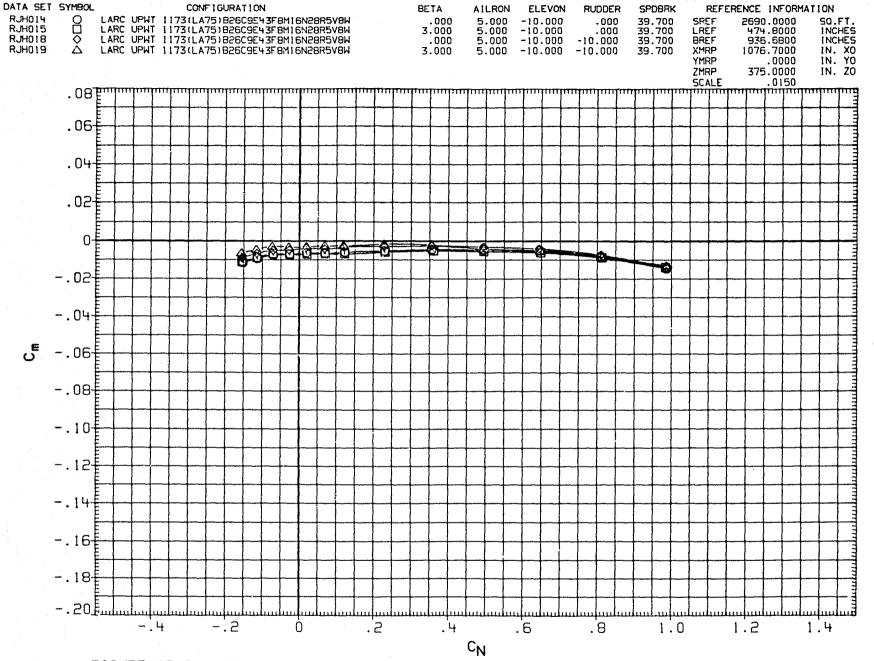


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 534

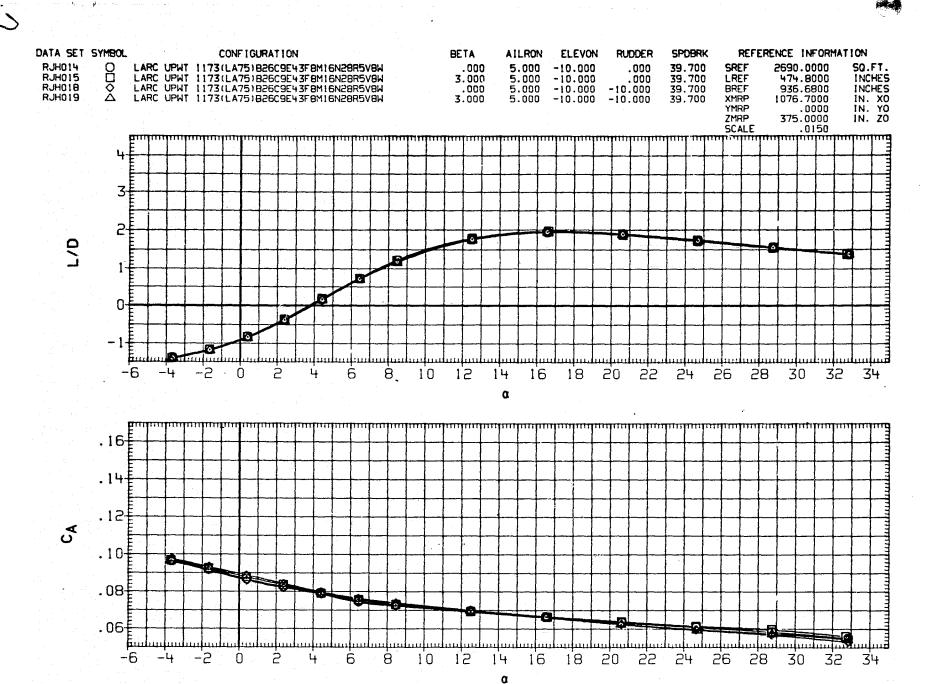


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

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PAGE

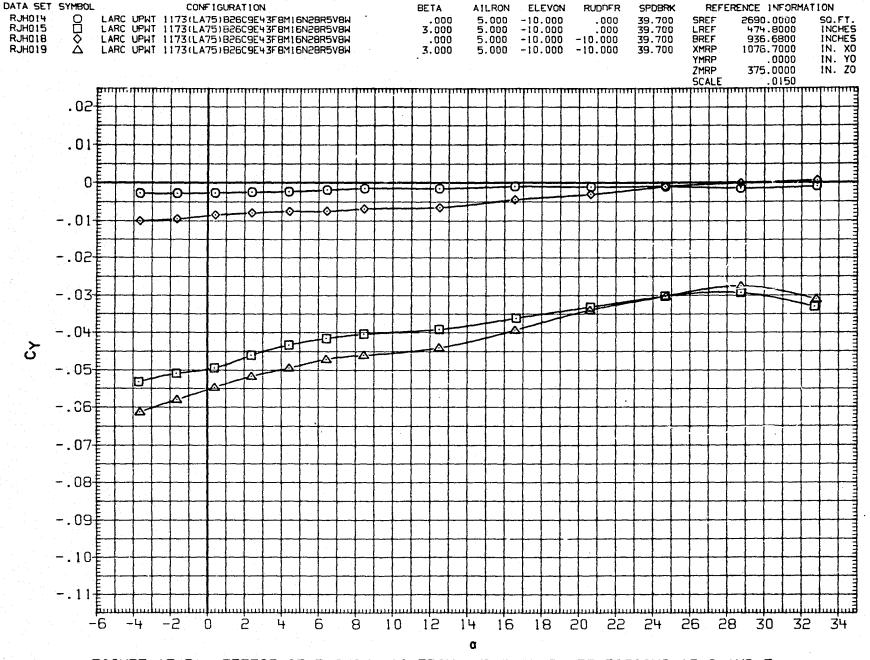


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE 536

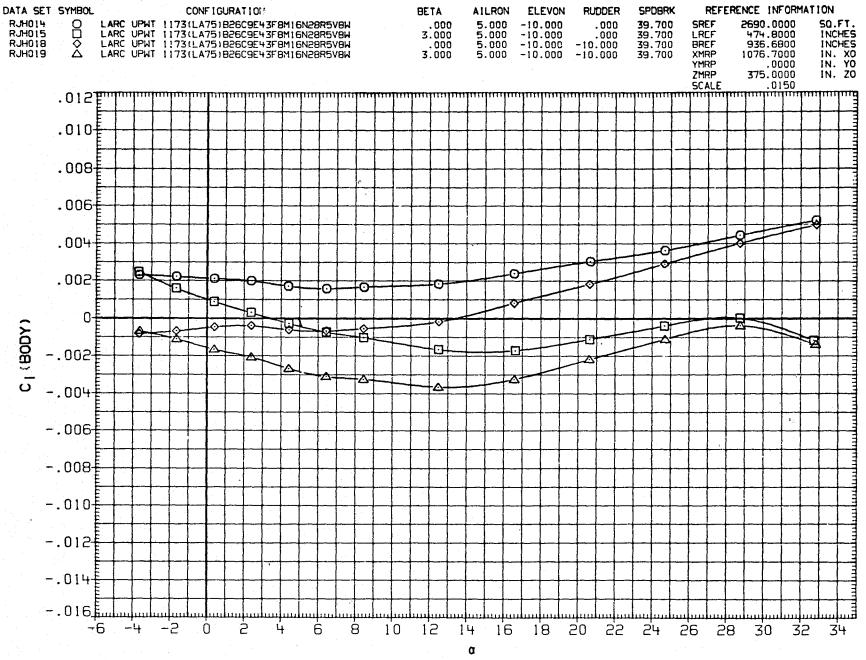


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(B)MACH = 3.90

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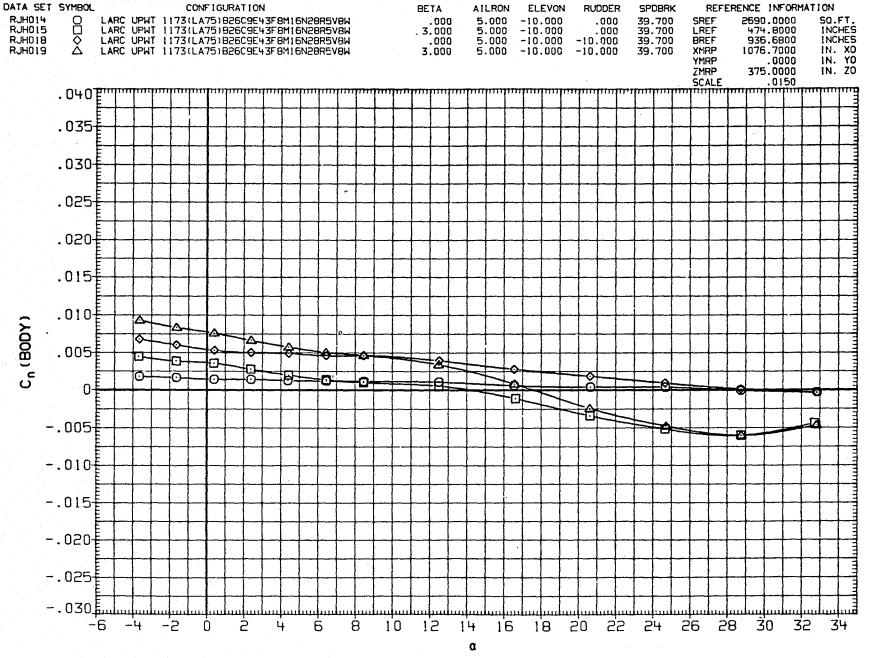


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(B) MACH = 3.90
PAGE 538

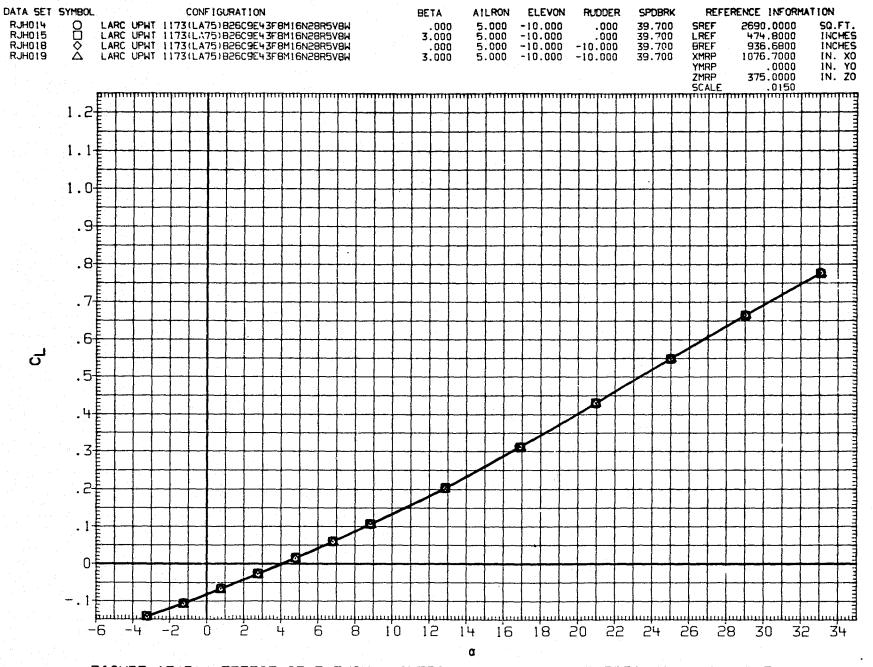


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE

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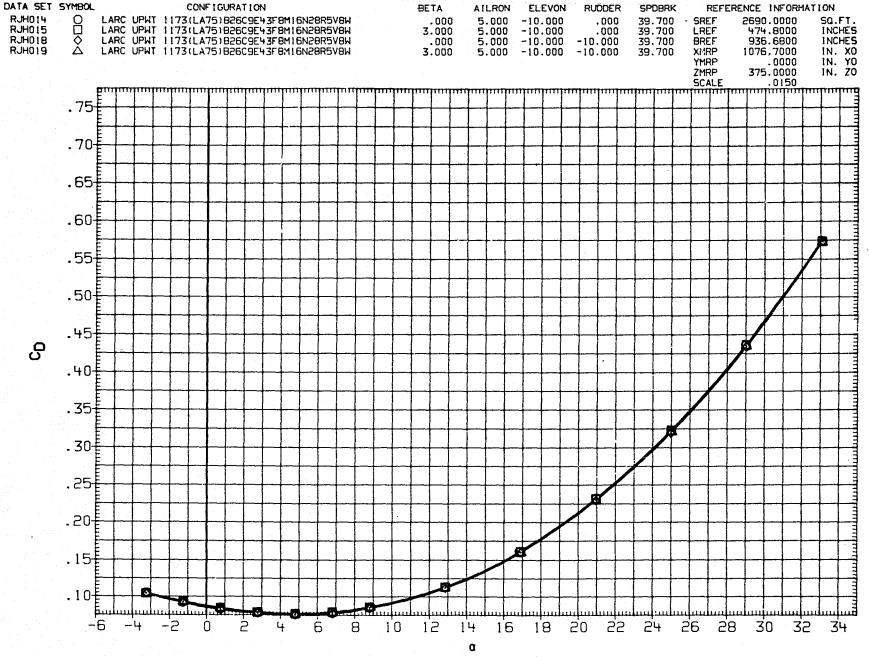
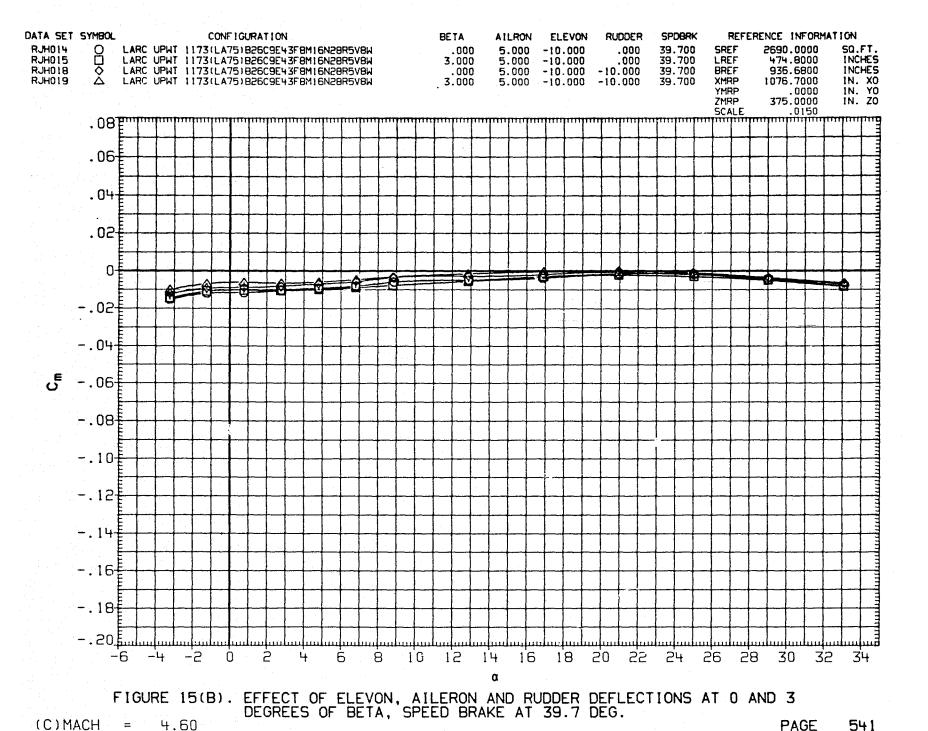


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
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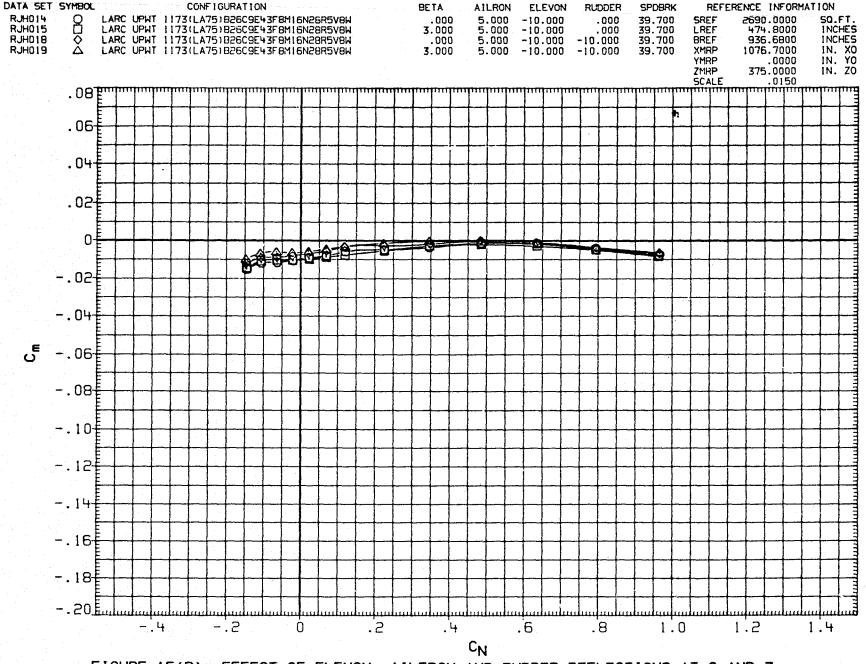


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 542

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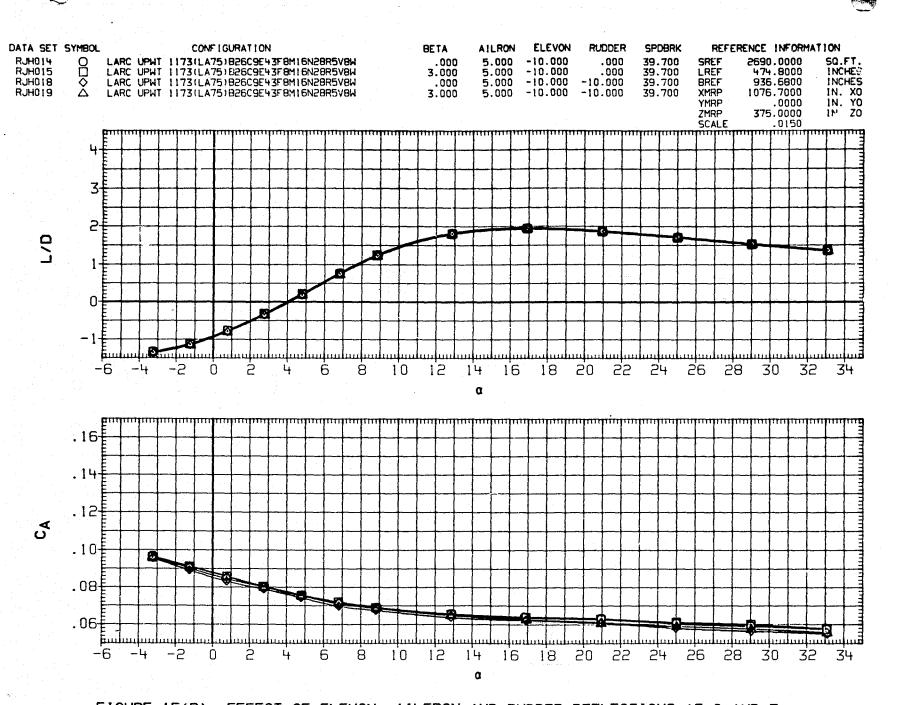
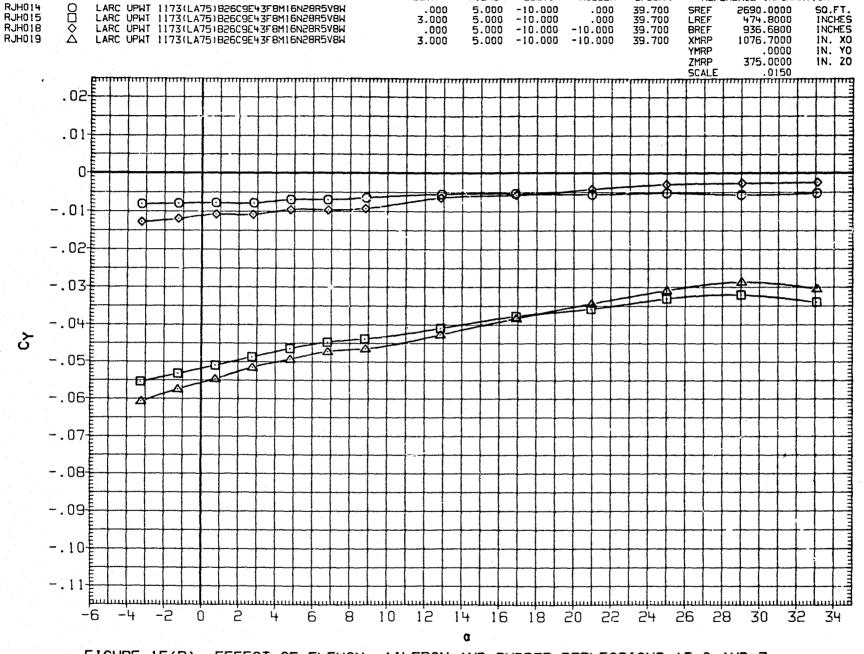


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(C) MACH = 4.60
PAGE 543

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BETA

AILRON

ELEVON

RUDDER

SPOBRK

REFERENCE INFORMATION

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FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 544

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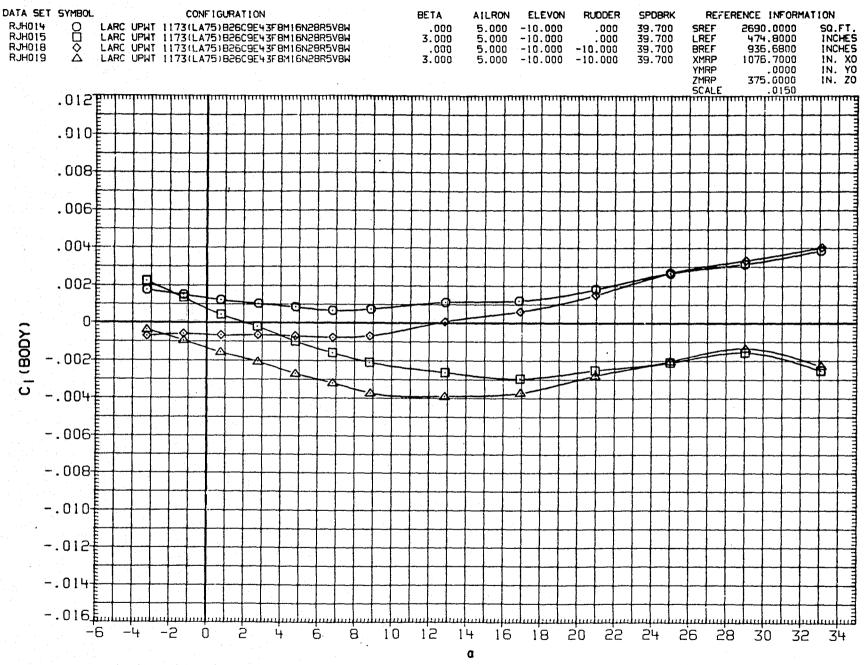


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE

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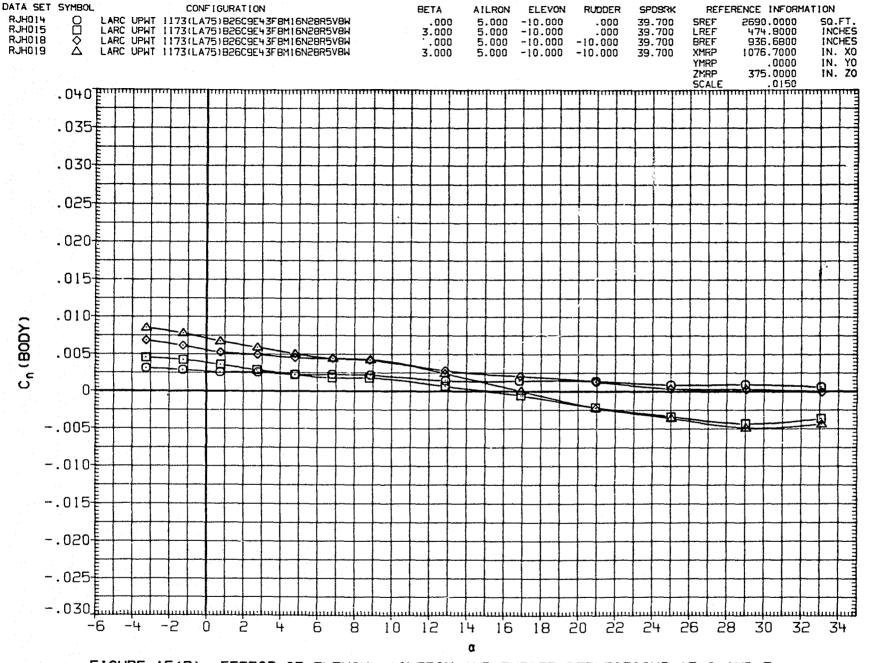


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 546

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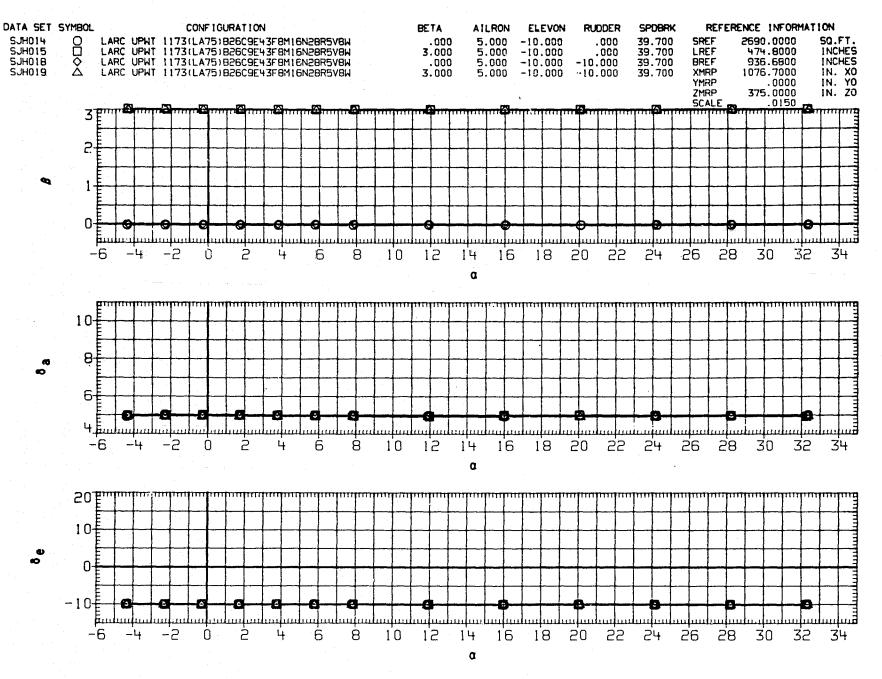


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.

(A) MACH = 2.86
PAGE

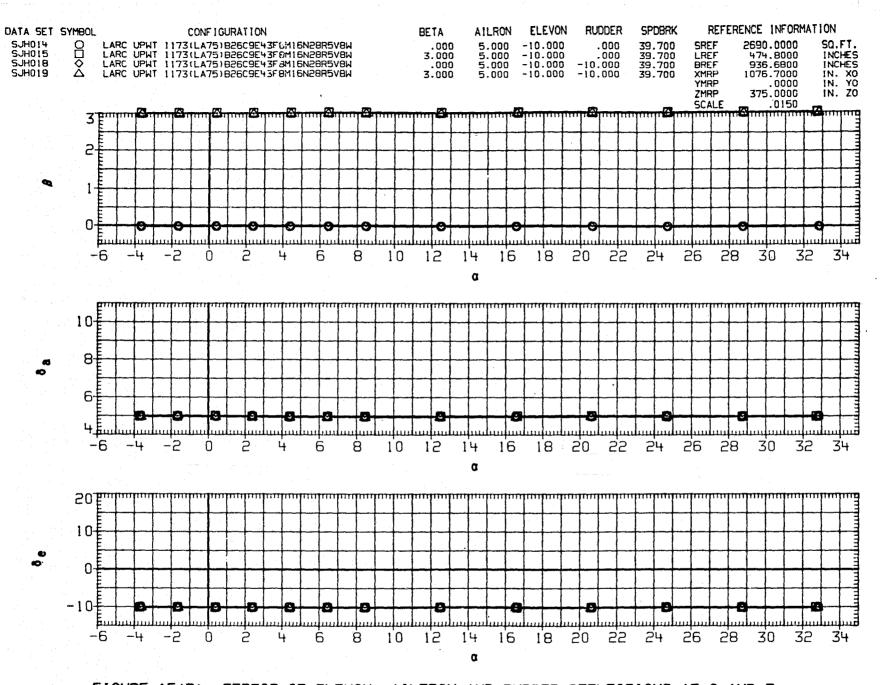


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 548

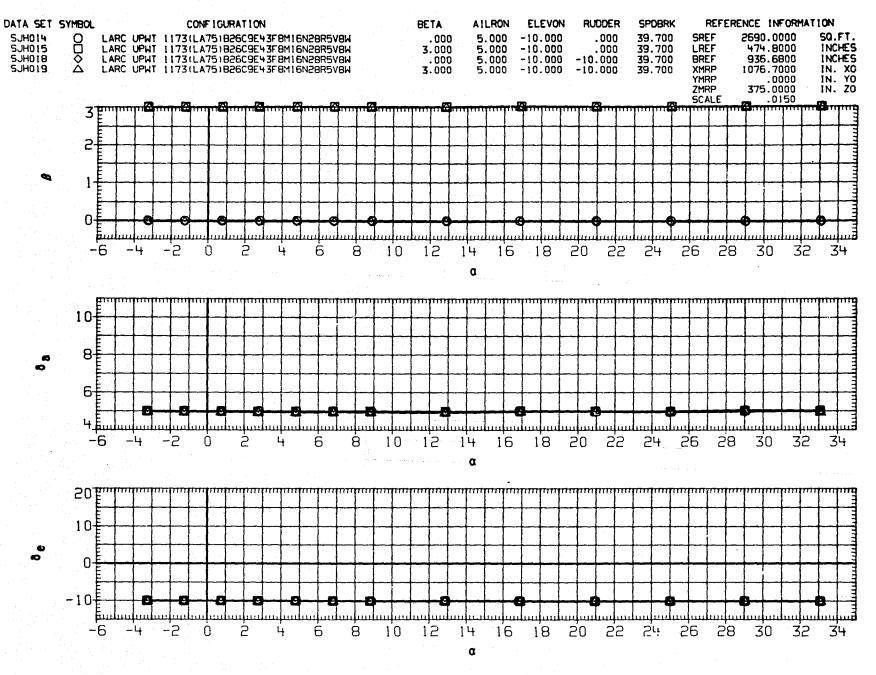


FIGURE 15(B). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 39.7 DEG.
PAGE 549

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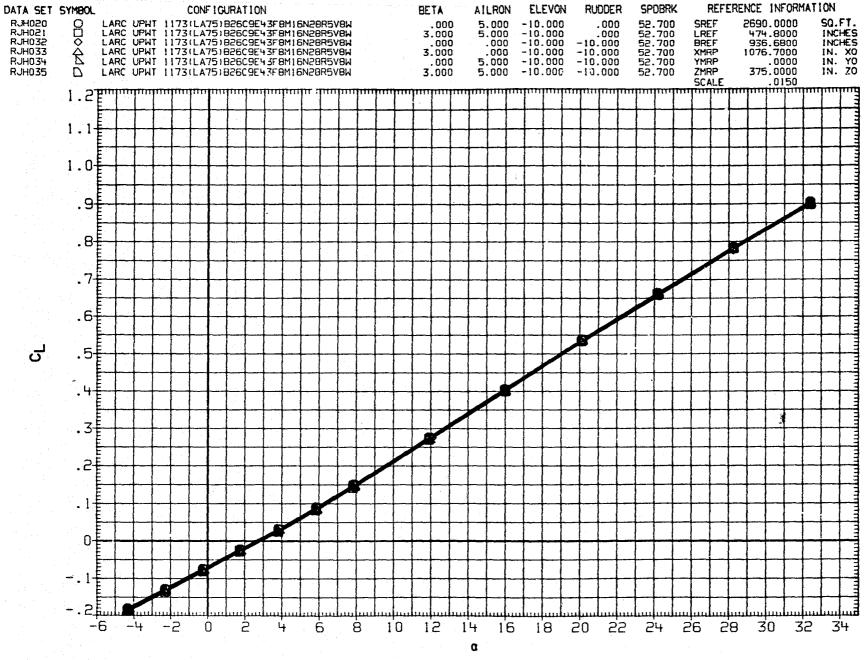


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 550

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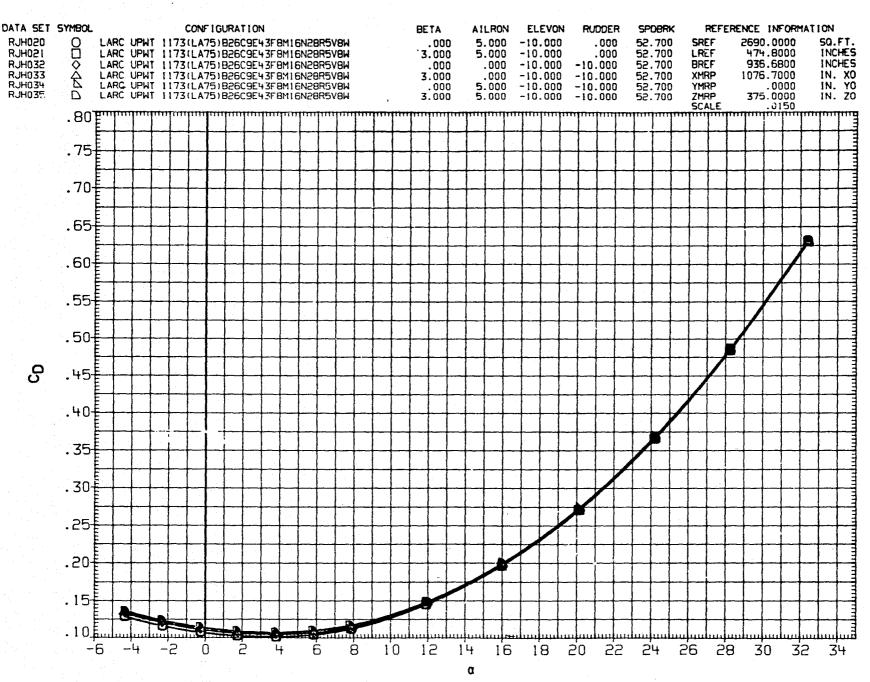


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(A)MACH = 2.86

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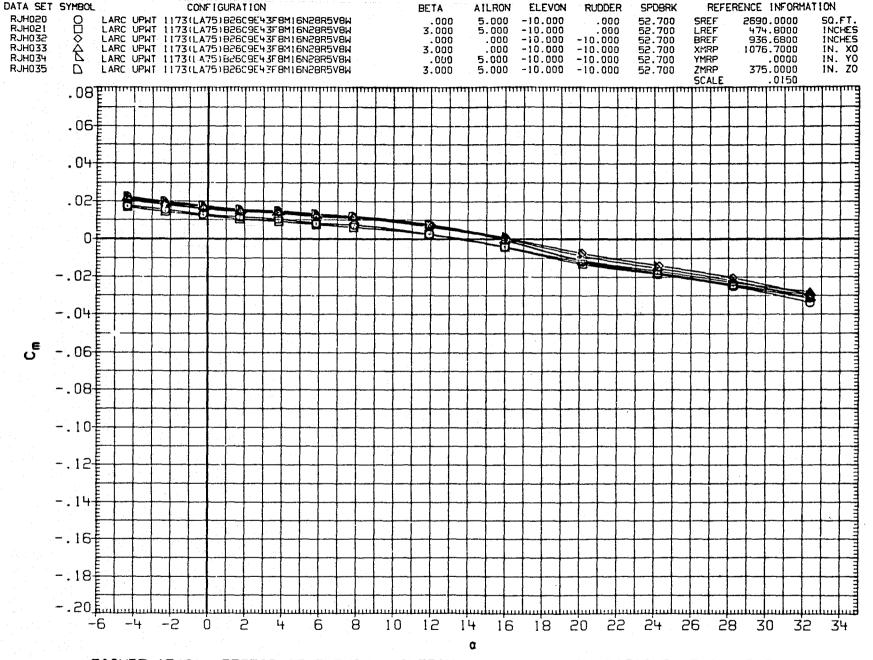


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 552

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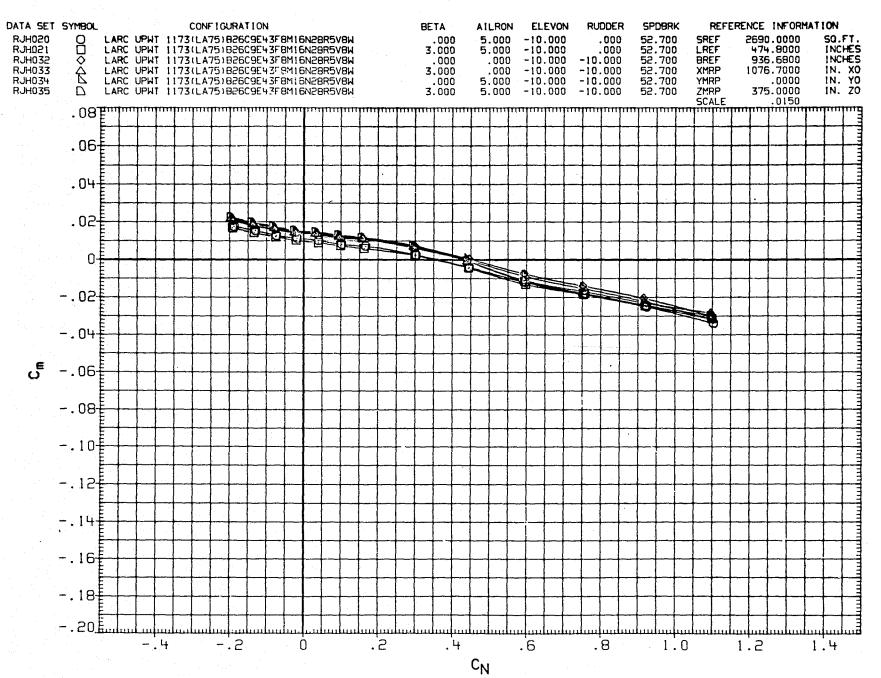


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
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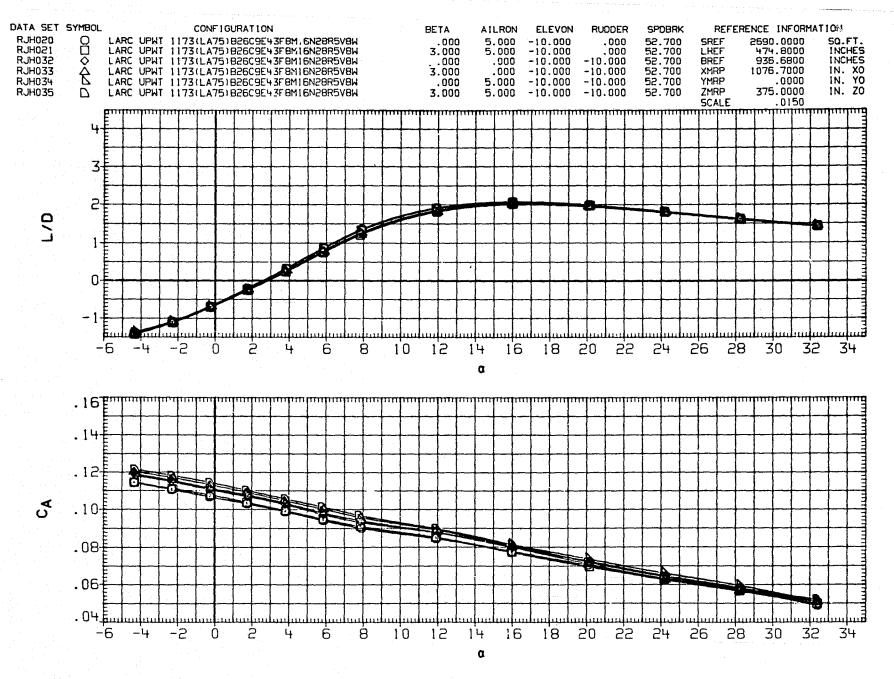


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 554

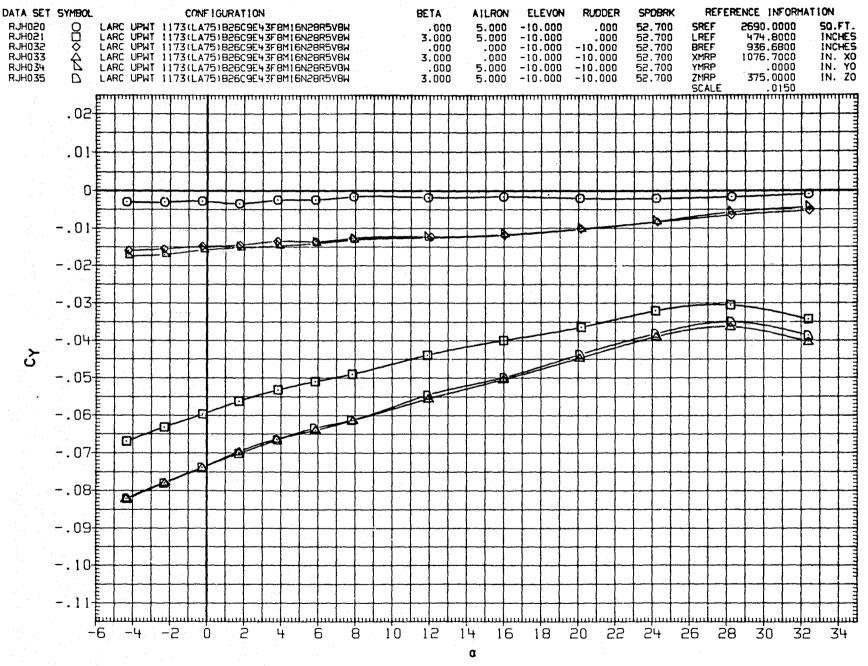


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86
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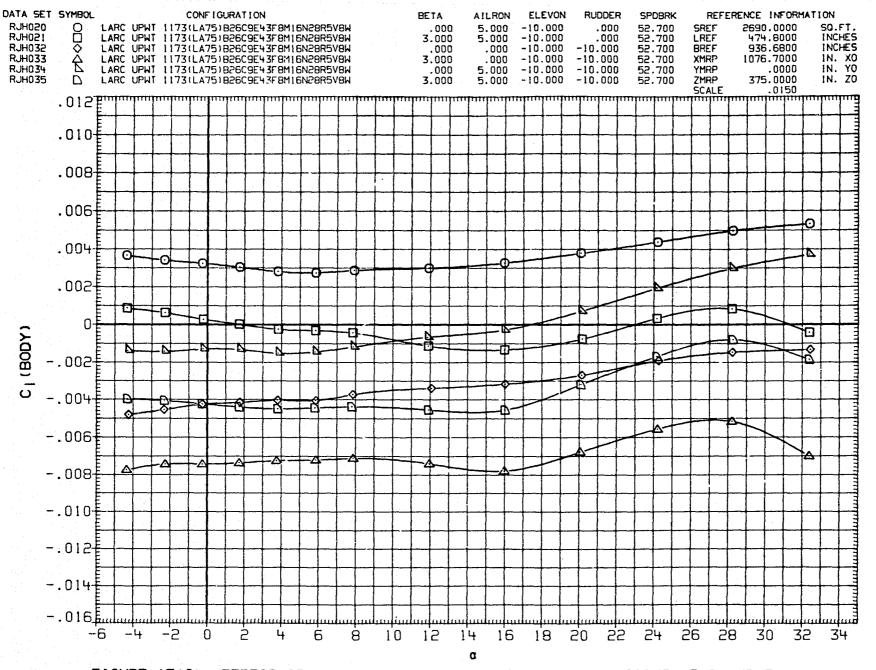


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 556



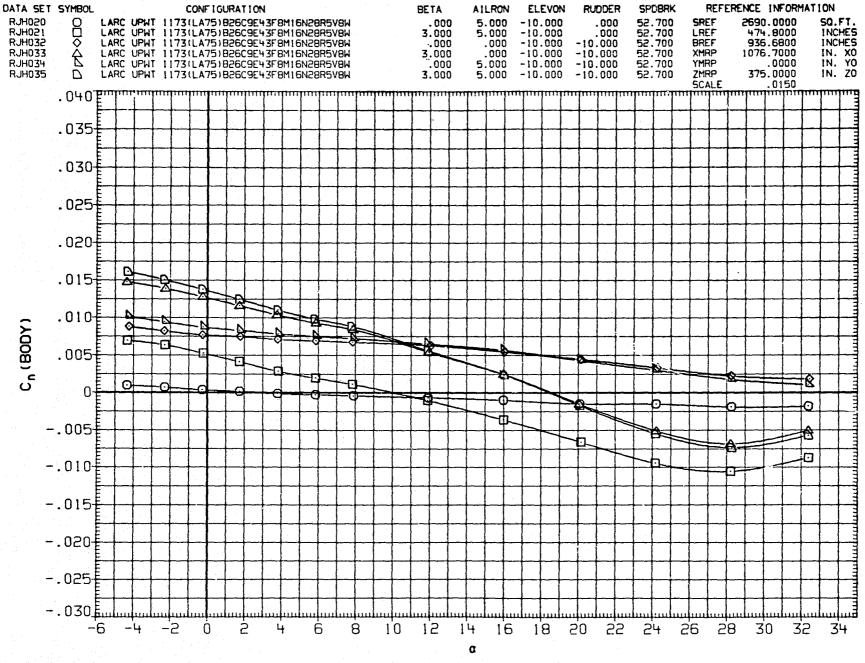


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(A)MACH = 2.86

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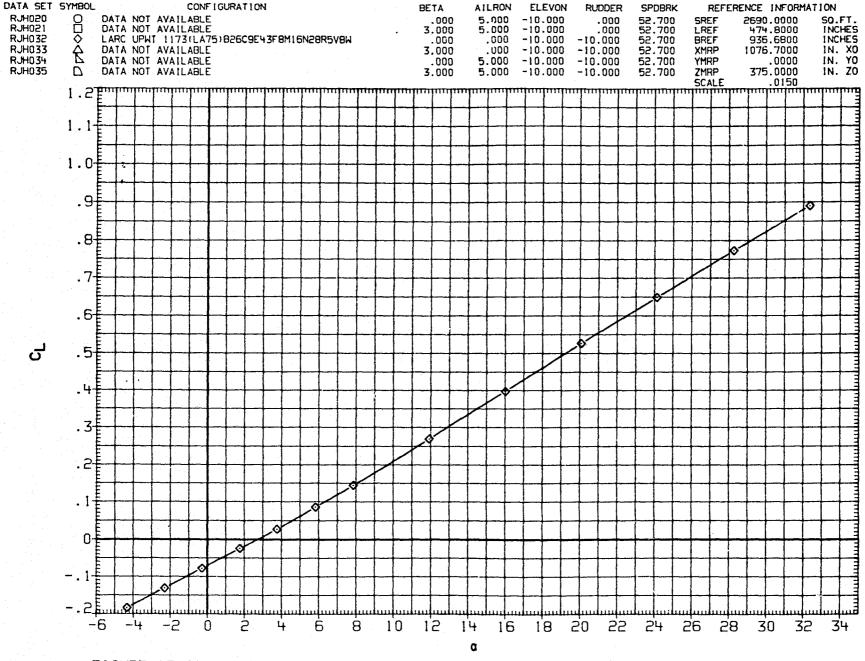


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(B) MACH = 2.90
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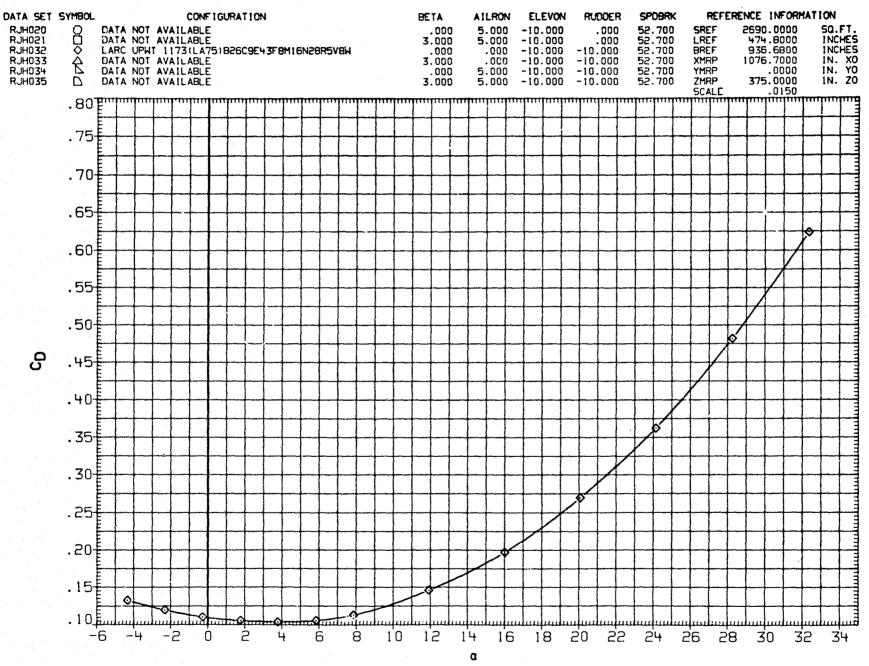


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(B)MACH = 2.90

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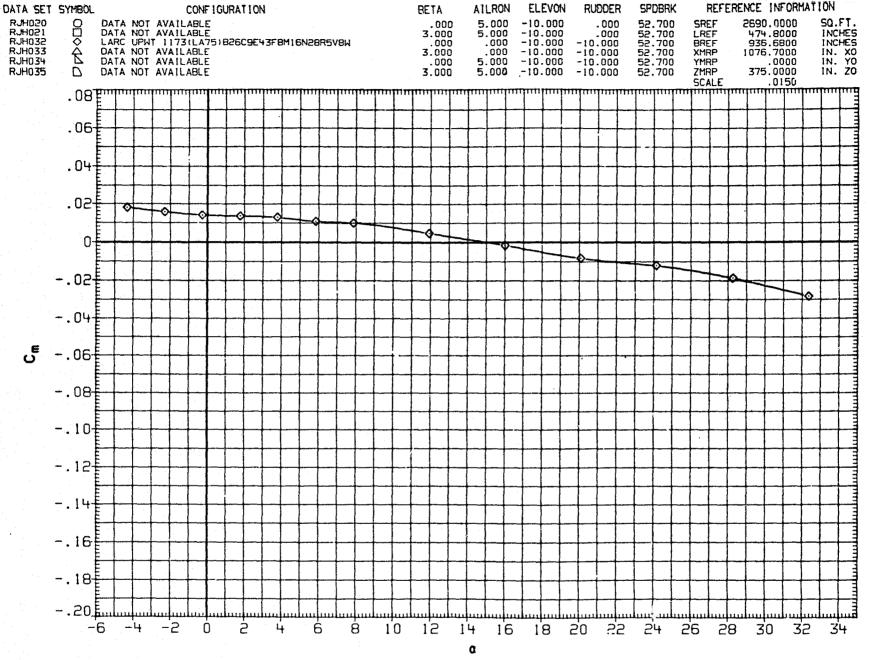


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 560

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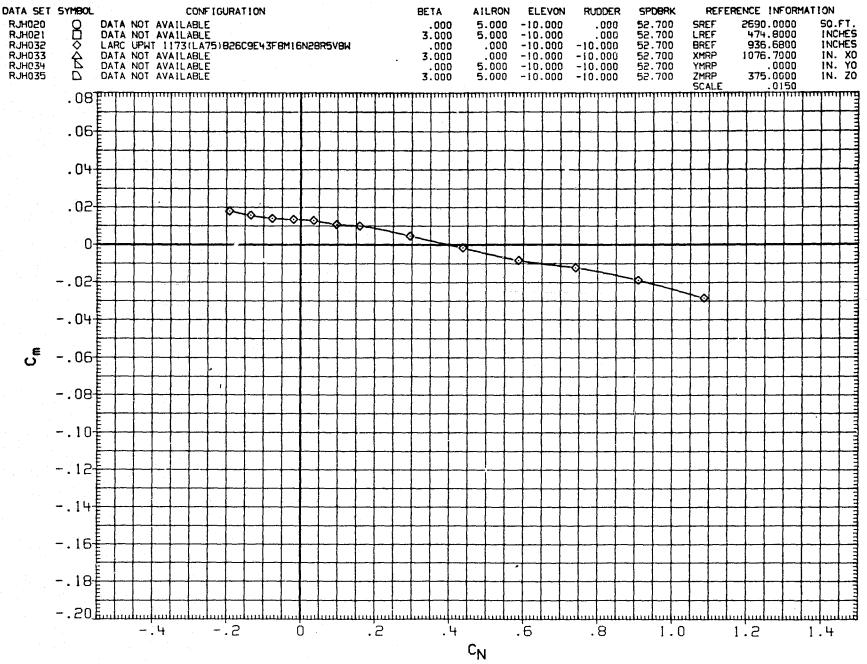


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT D AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(B) MACH = 2.90
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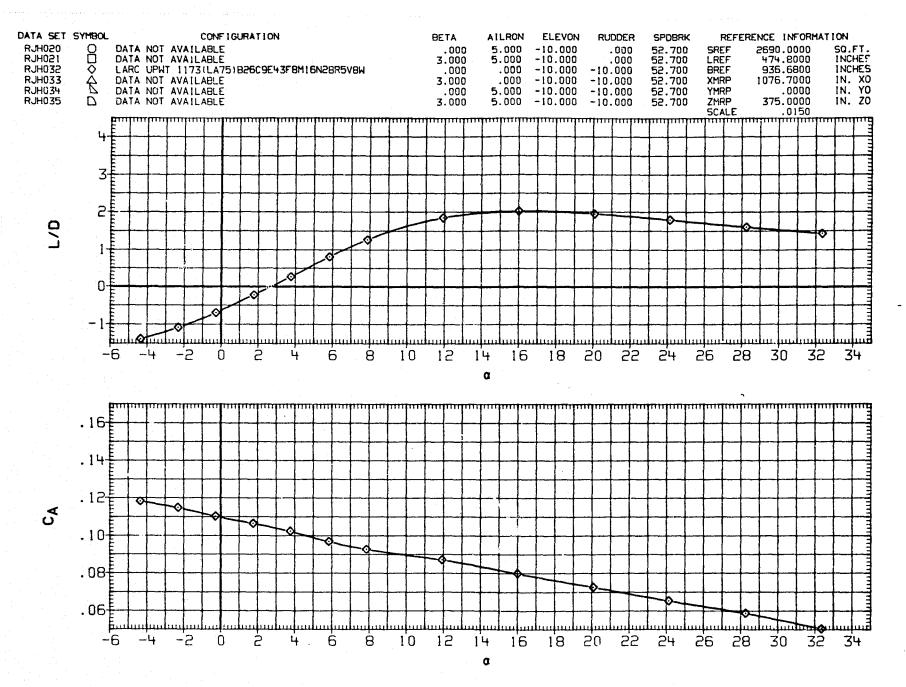


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 562



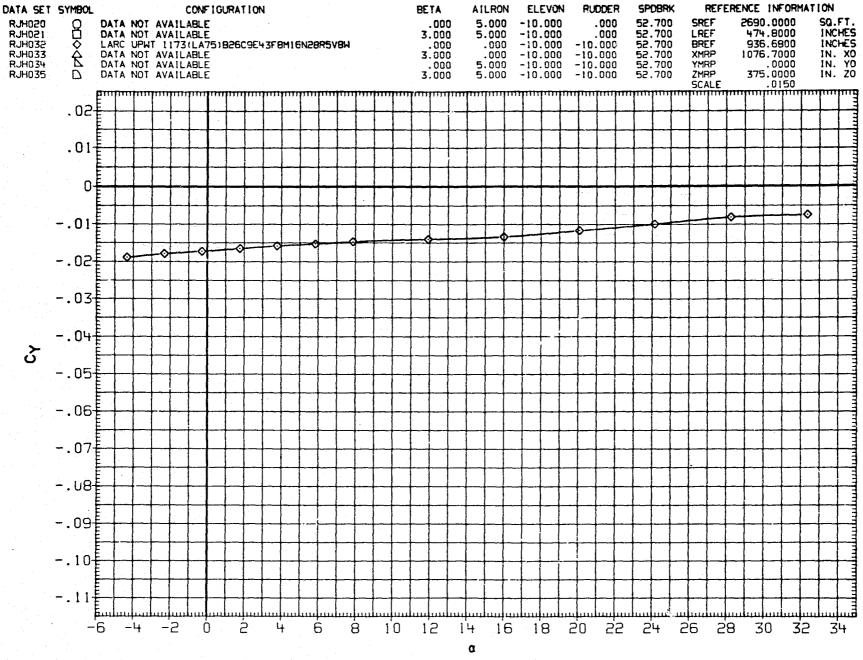


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(B)MACH =2.90

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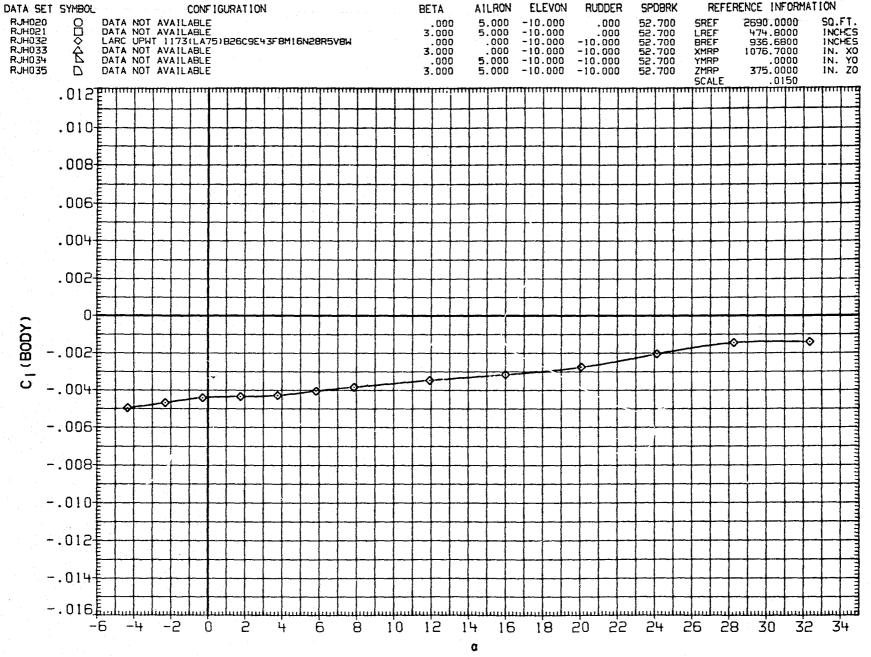


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(B) MACH = 2.90
PAGE 564

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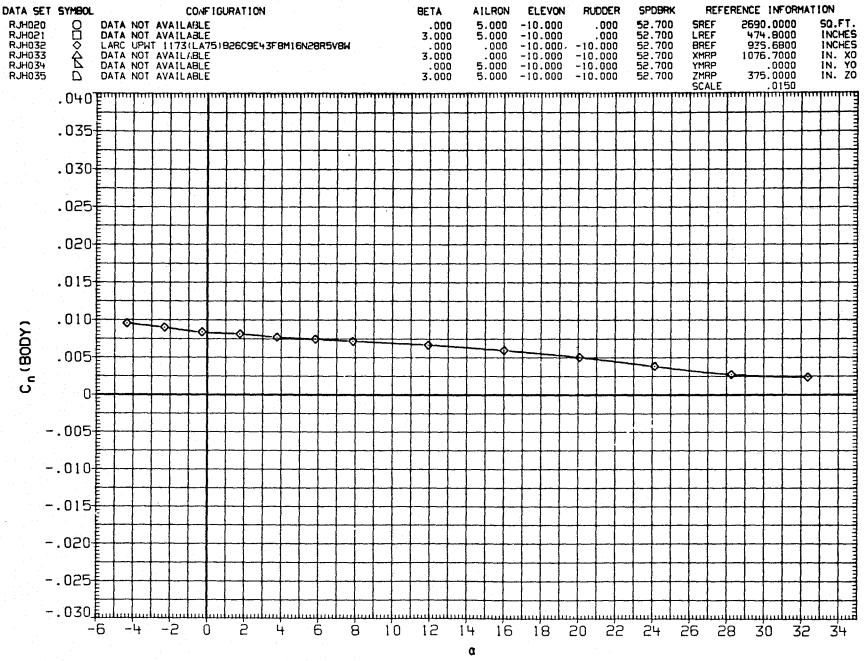


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
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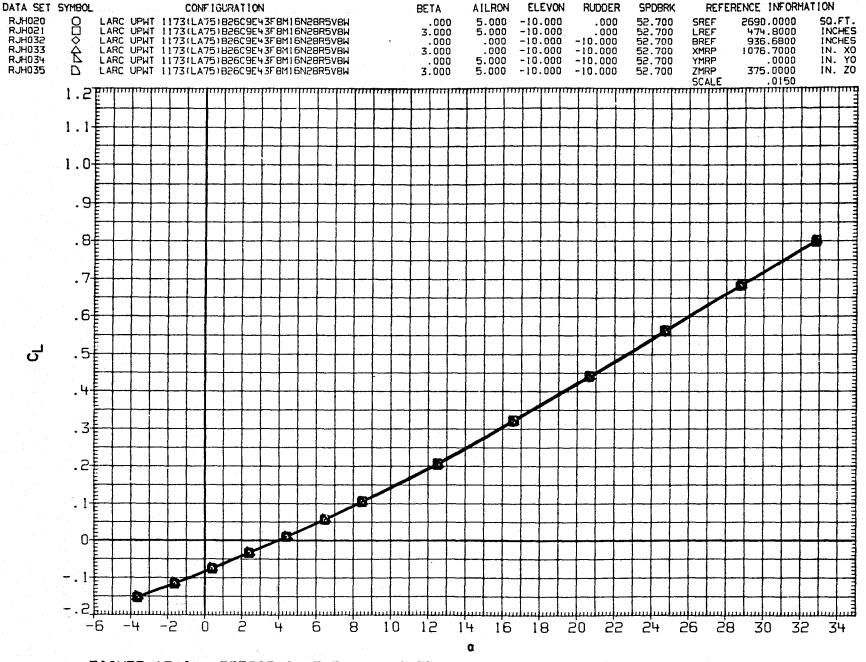


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 566



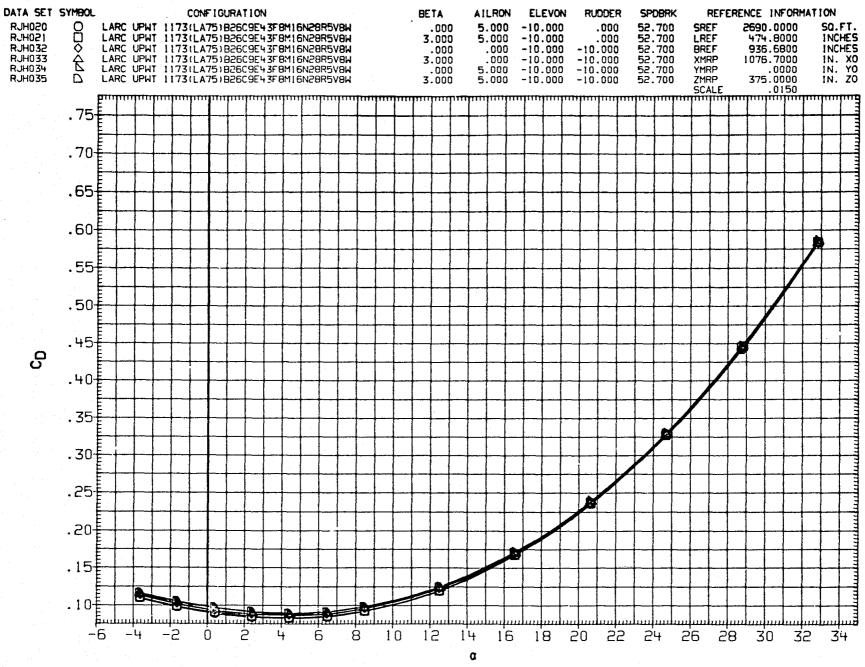


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 3.90
PAGE 3.90

(C)MACH = 3.90

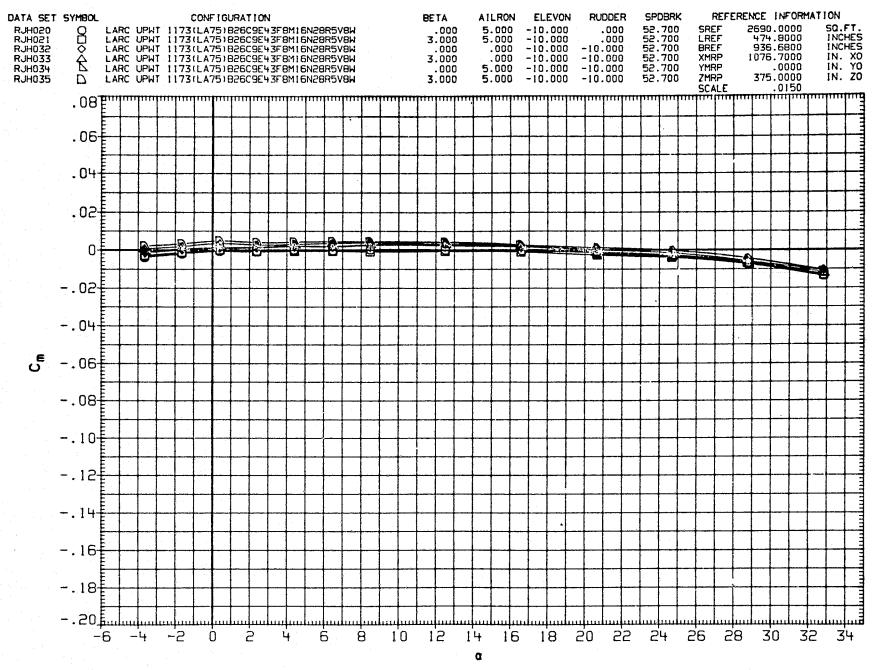


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(C)MACH = 3.90
PAGE 568

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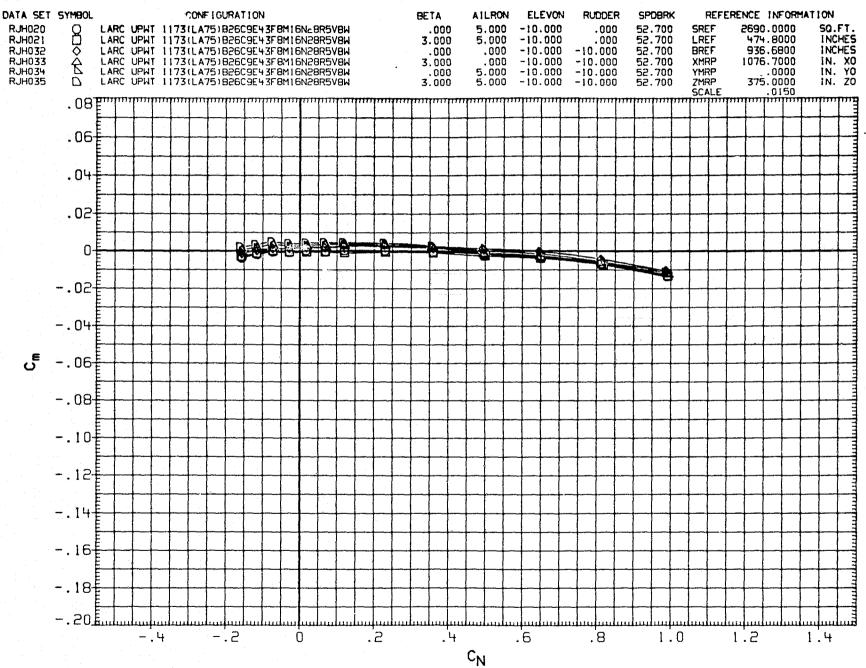


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(C)MACH =3.90 PAGE

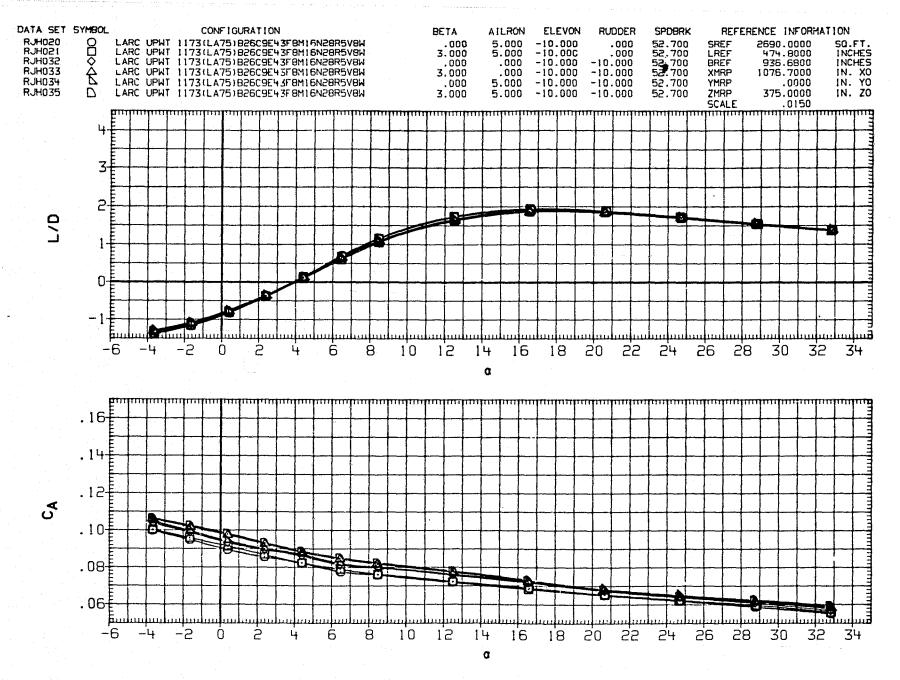


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 570

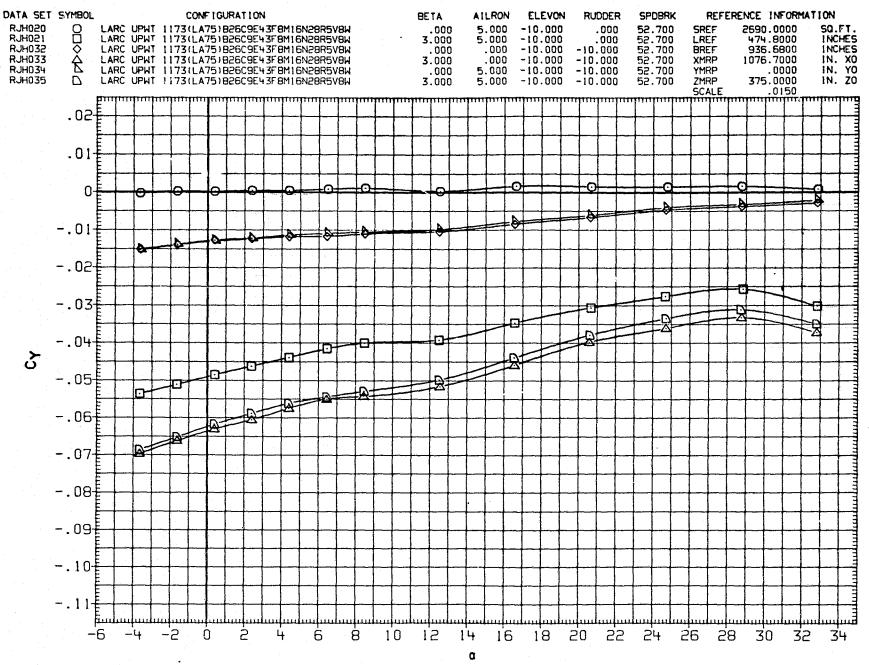


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(C)MACH =3.90

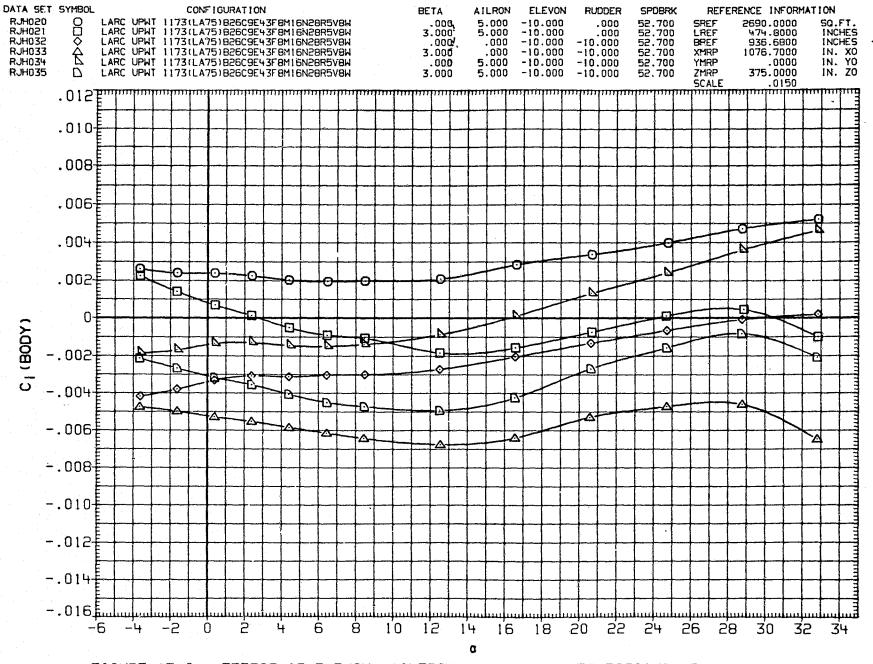


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 572

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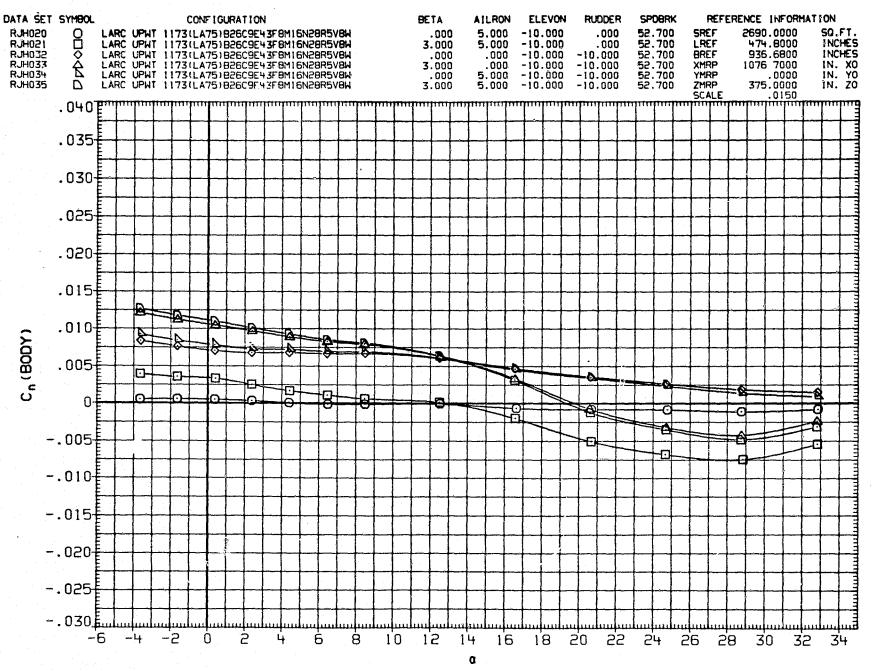


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(C) MACH = 3.90
PAGE

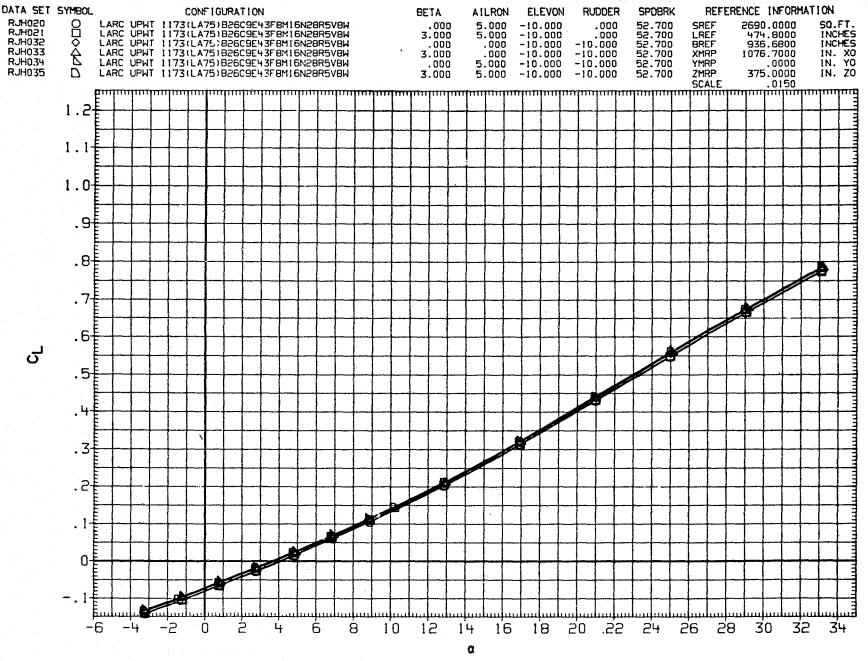


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 574

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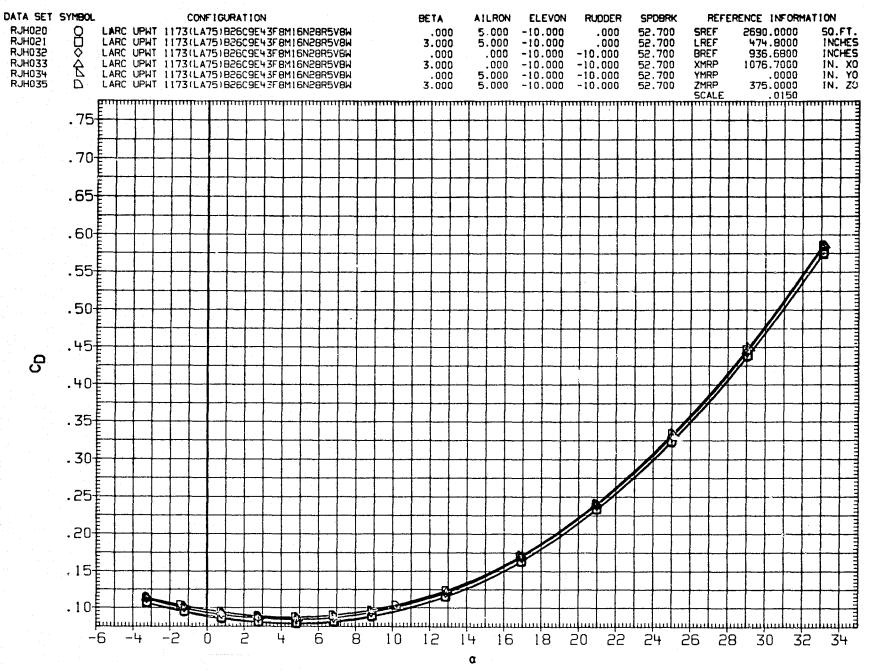


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(D) MACH = 4.60
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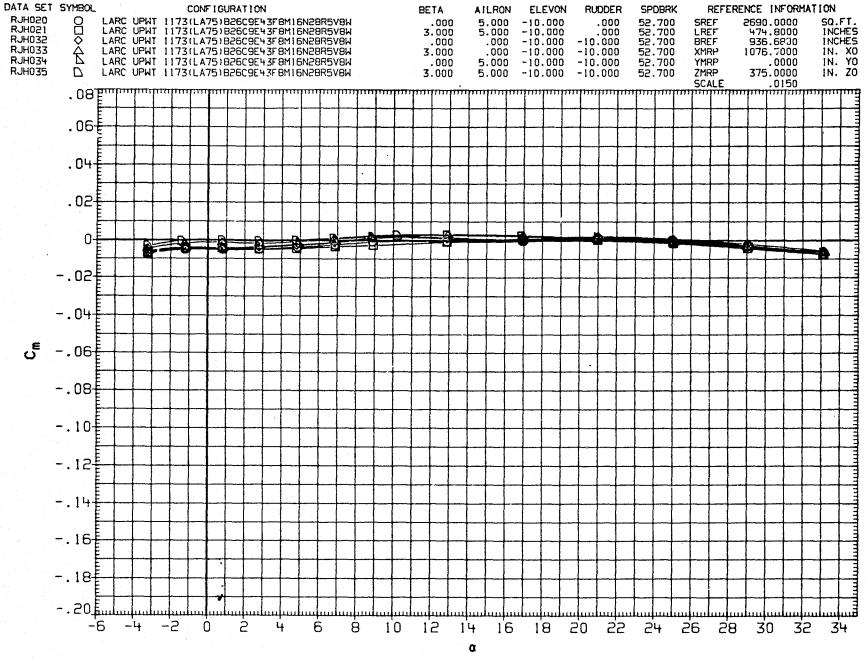


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 576

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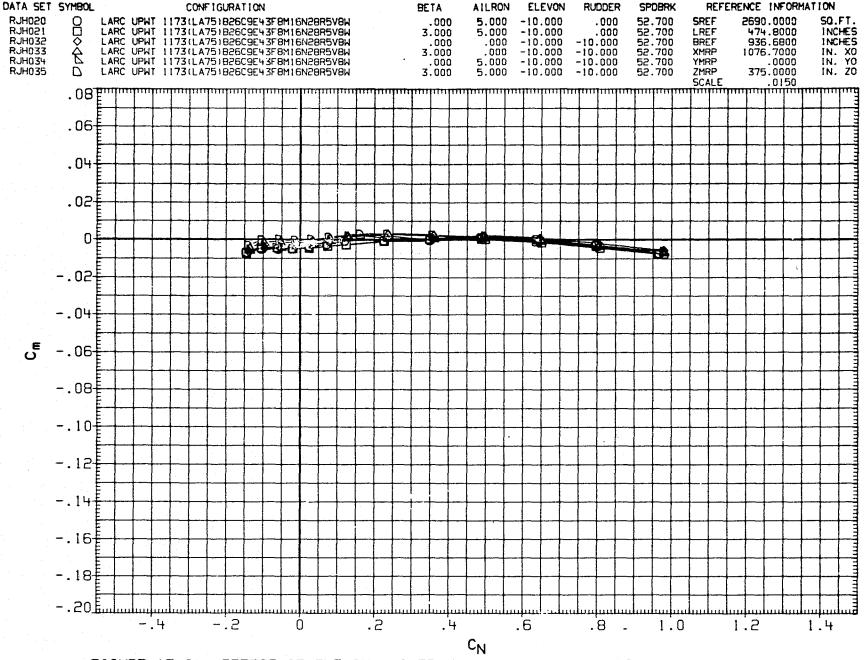


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(D) MACH = 4.60
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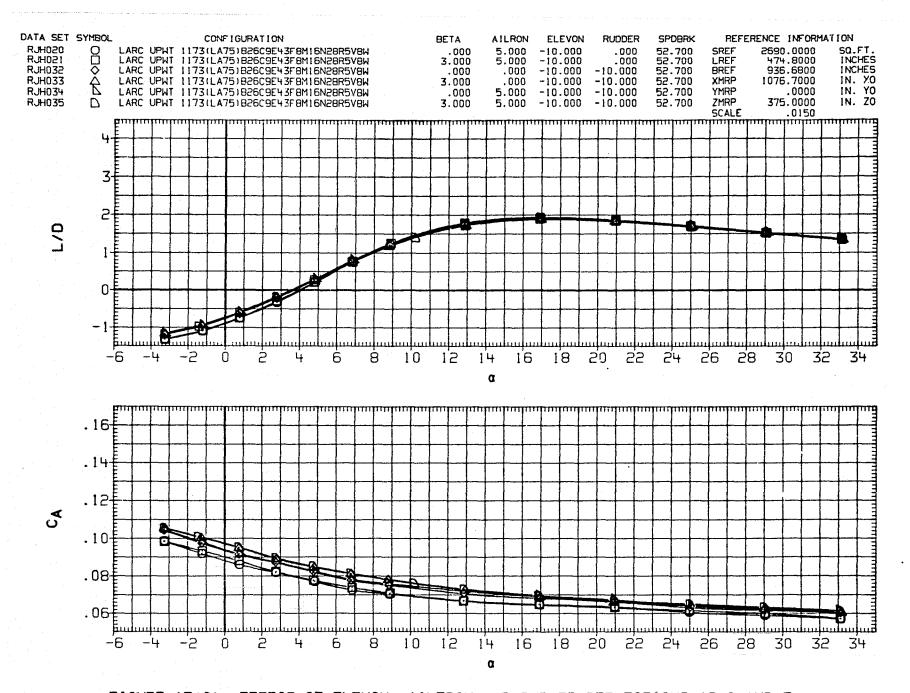


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 578

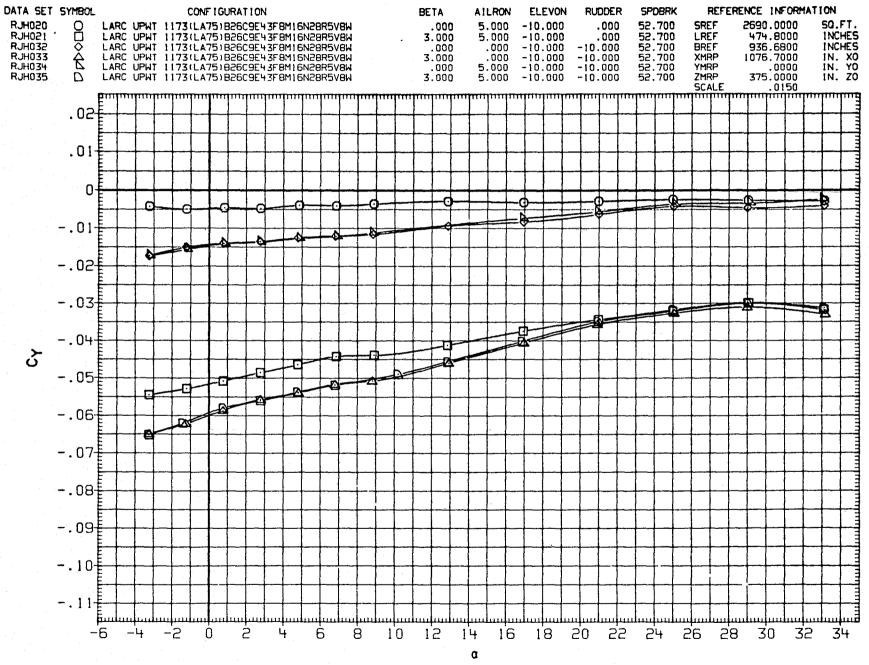


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
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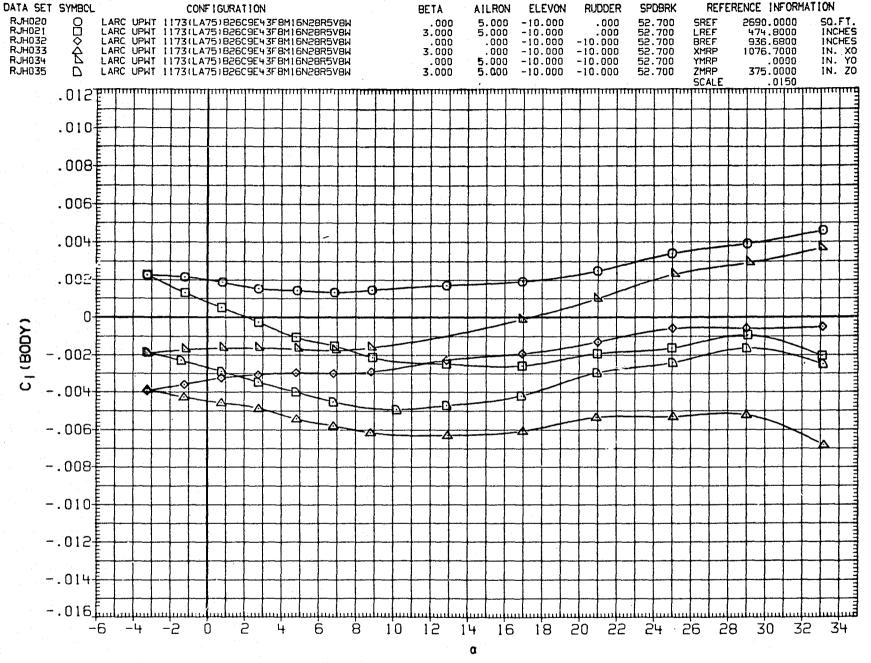


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(D)MACH = 4.60
PAGE



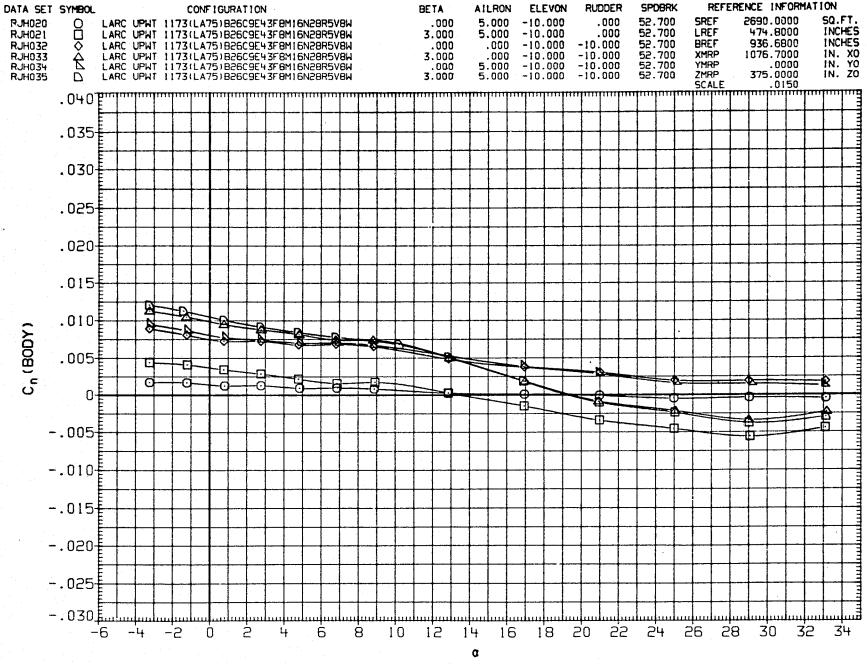


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(D) MACH = 4.60
PAGE

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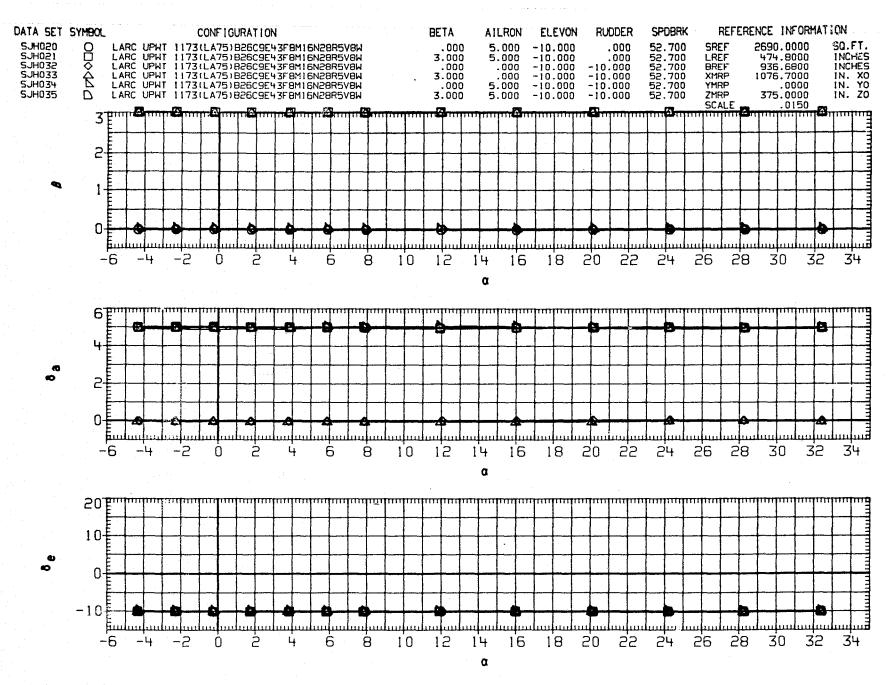


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.

(A) MACH = 2.86
PAGE 582

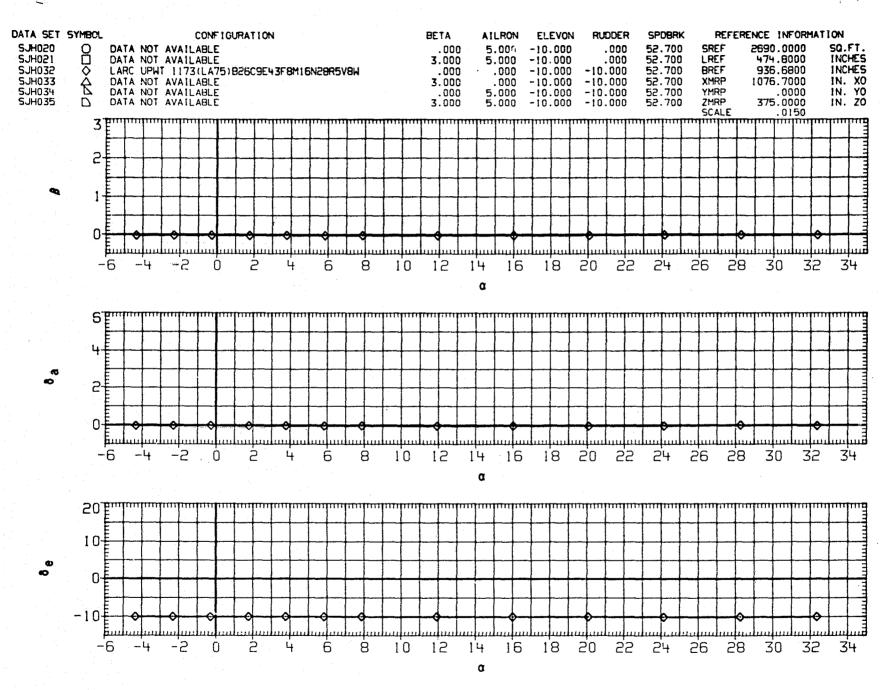


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG. 2.90

(B) MACH

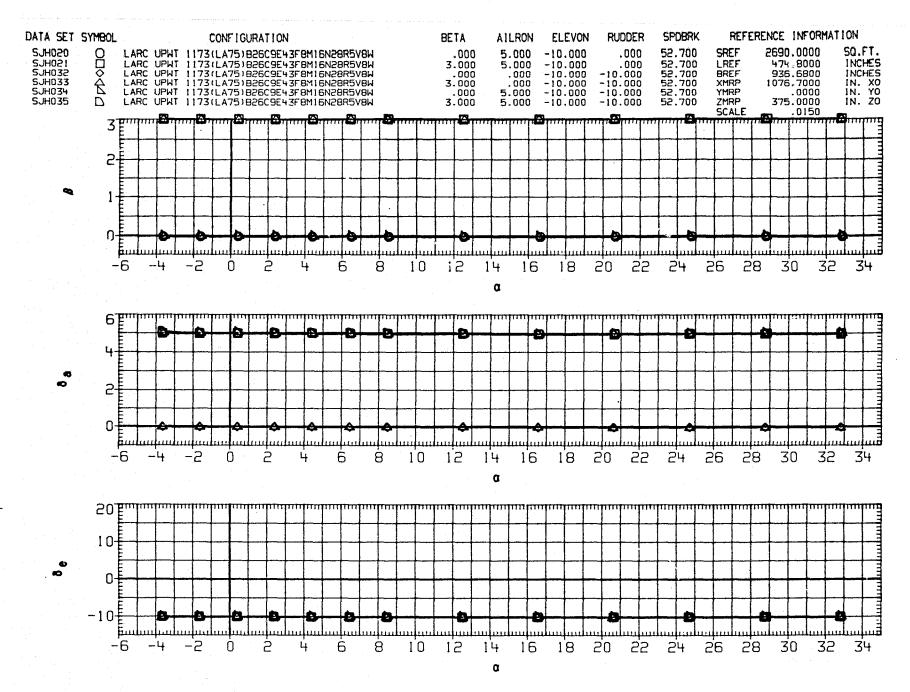


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG.
PAGE 584



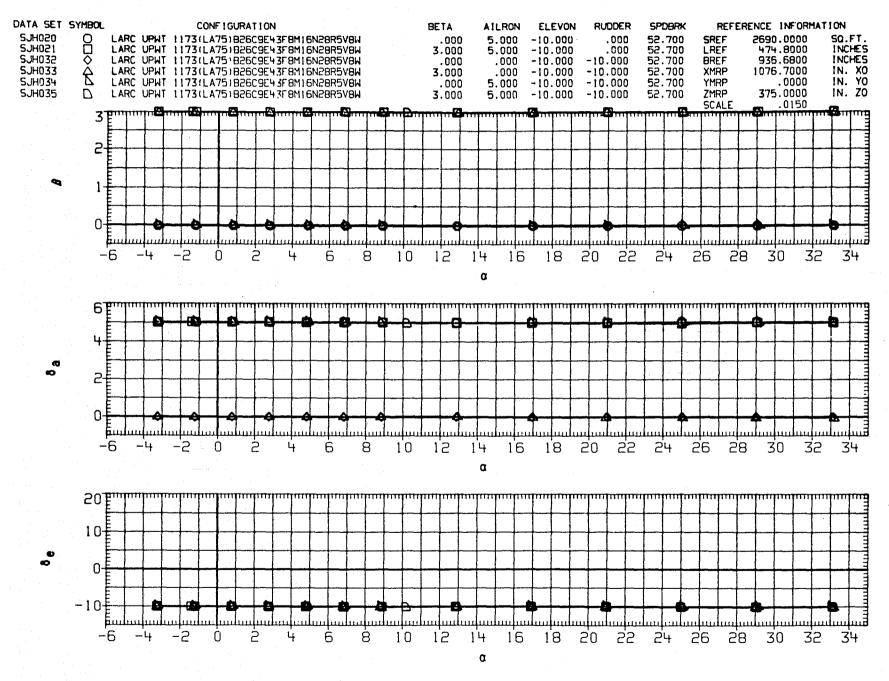


FIGURE 15(C). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 52.7 DEG. 4.60

(D) MACH

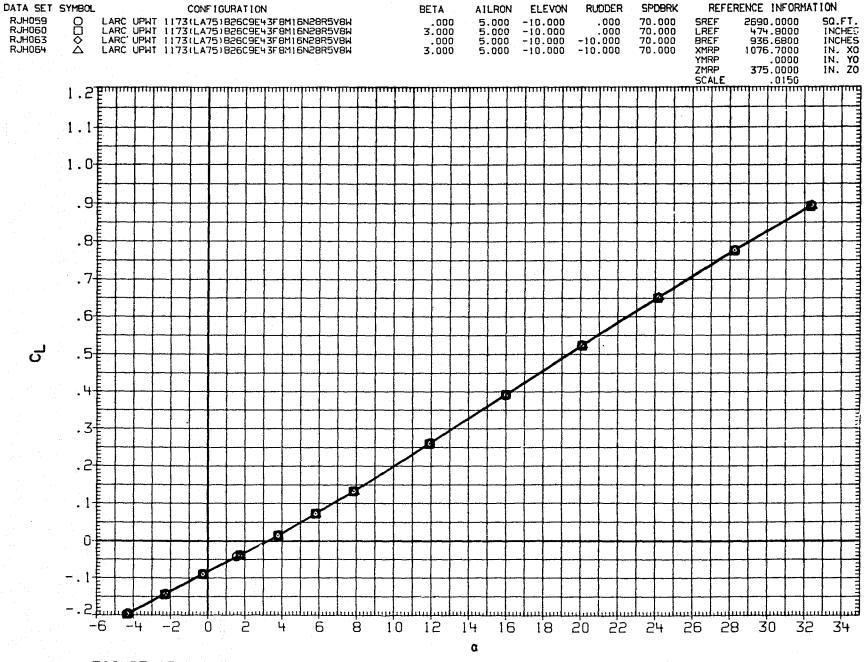


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A) MACH = 2.86
PAGE 586



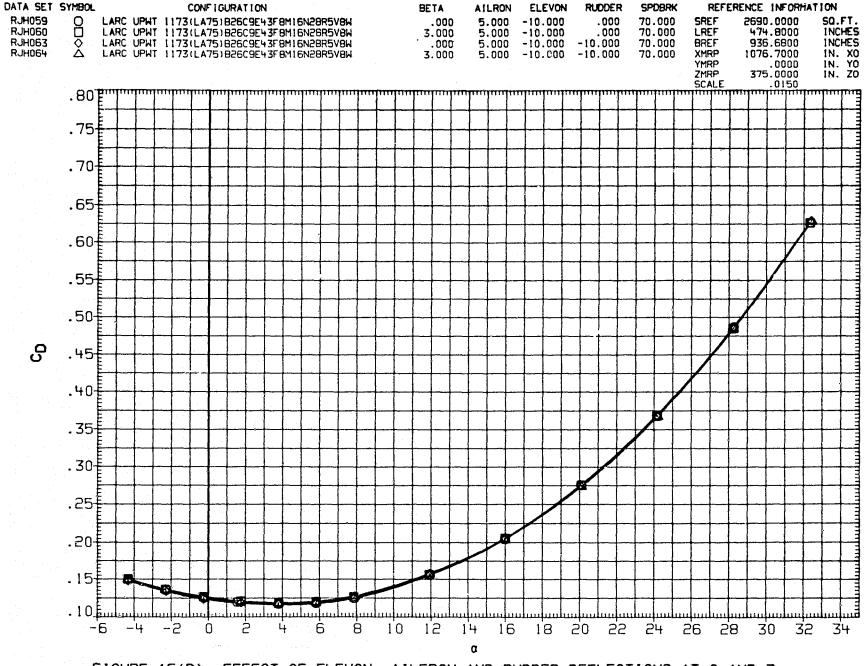


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A)MACH = 2.86

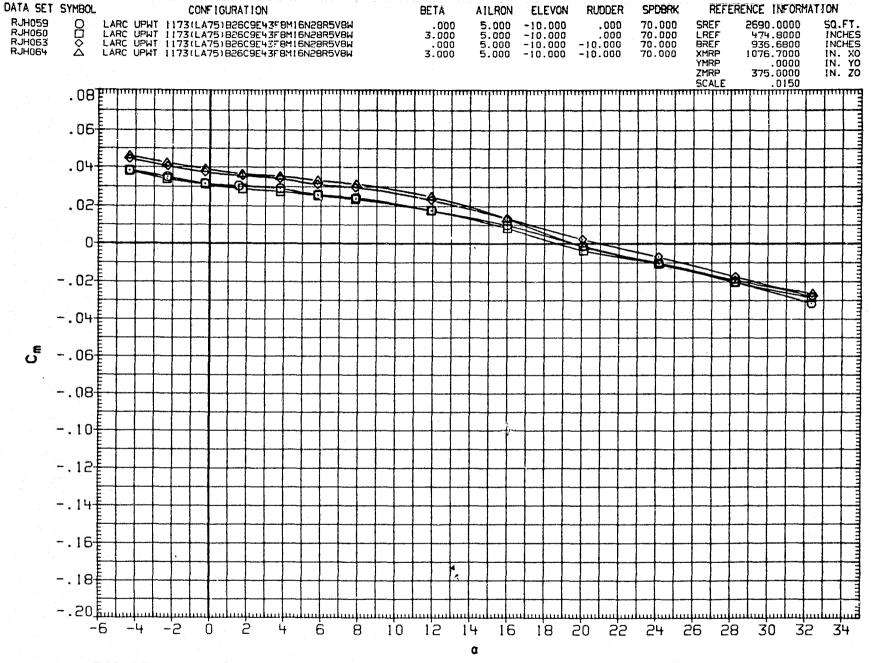


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A) MACH = 2.86
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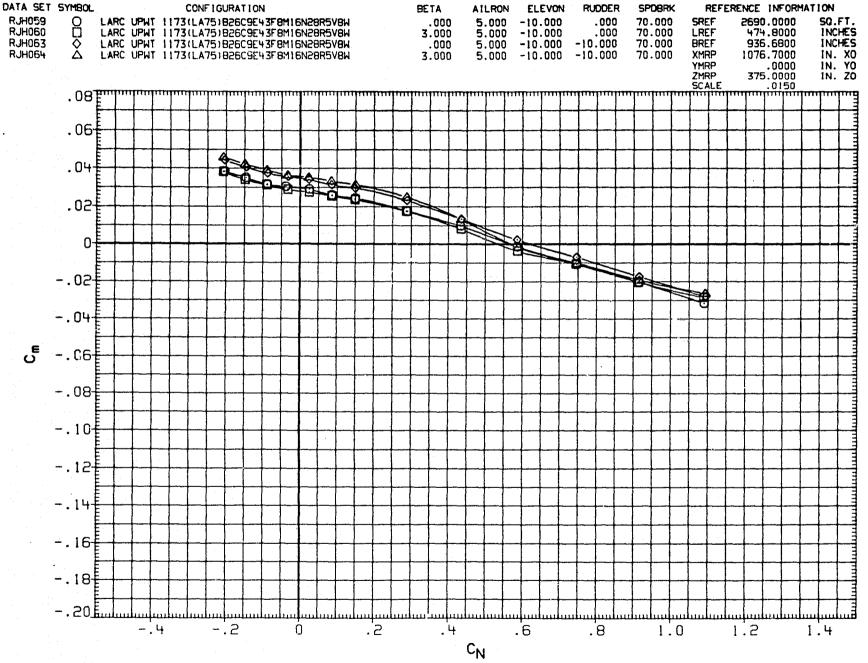


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A) MACH = 2.86 PAGE

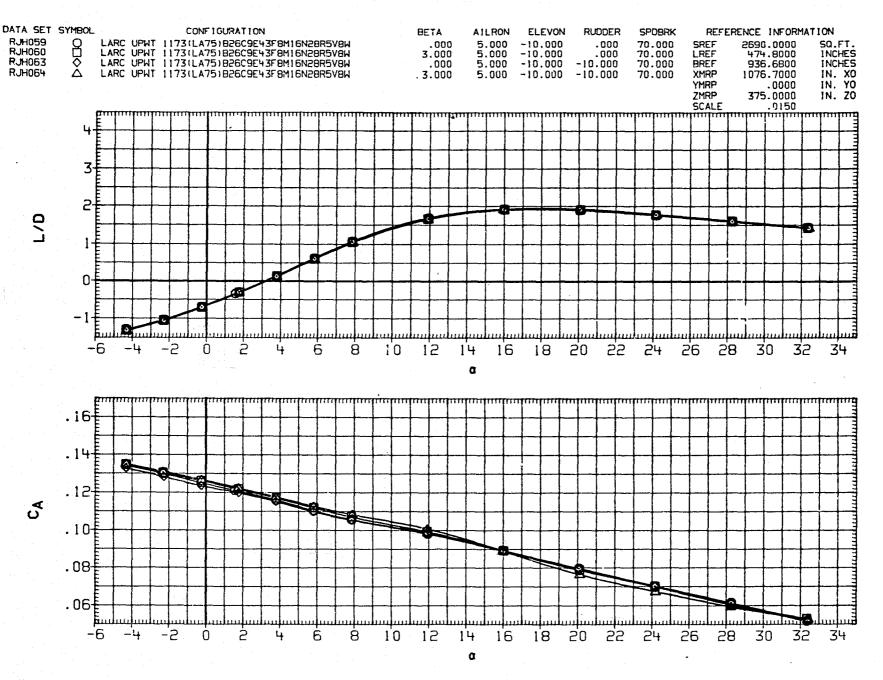


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 590

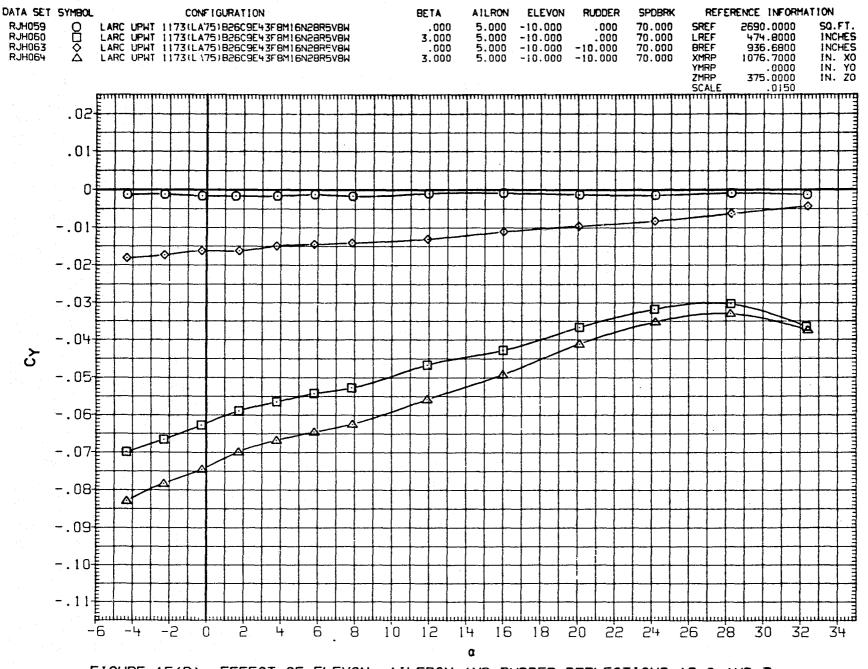


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A) MACH = 2.86
PAGE 591

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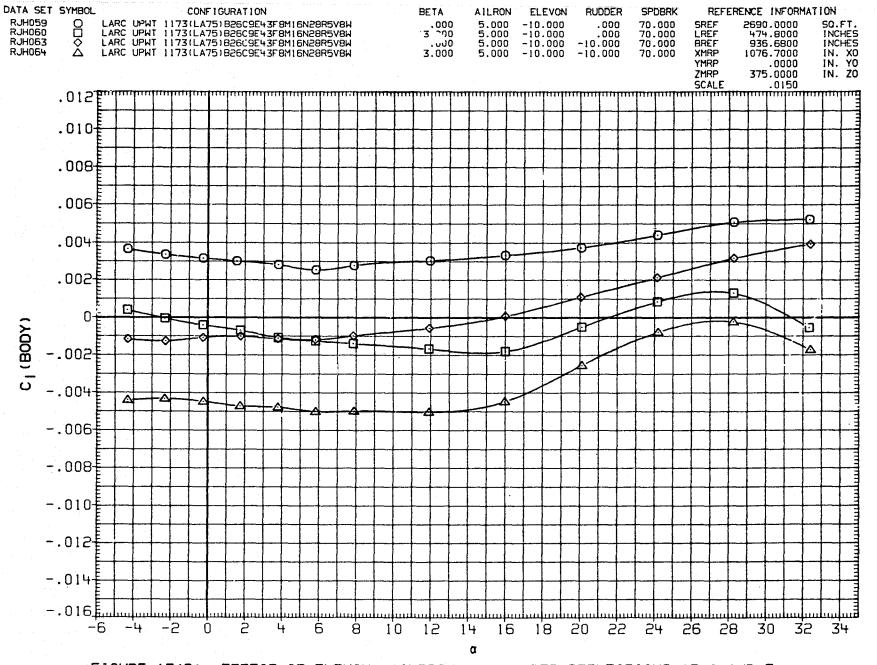


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 592

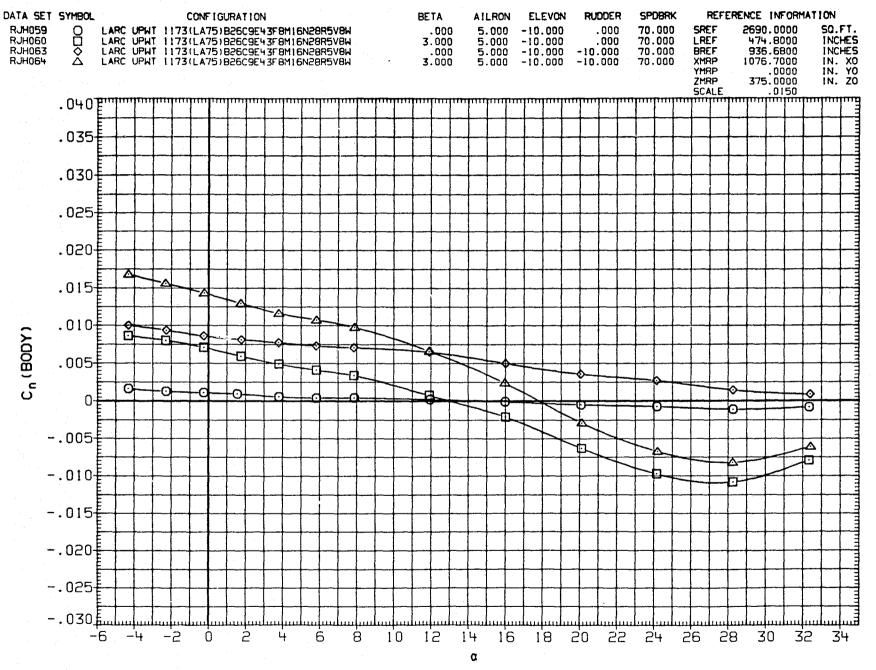


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(A)MACH = 2.86

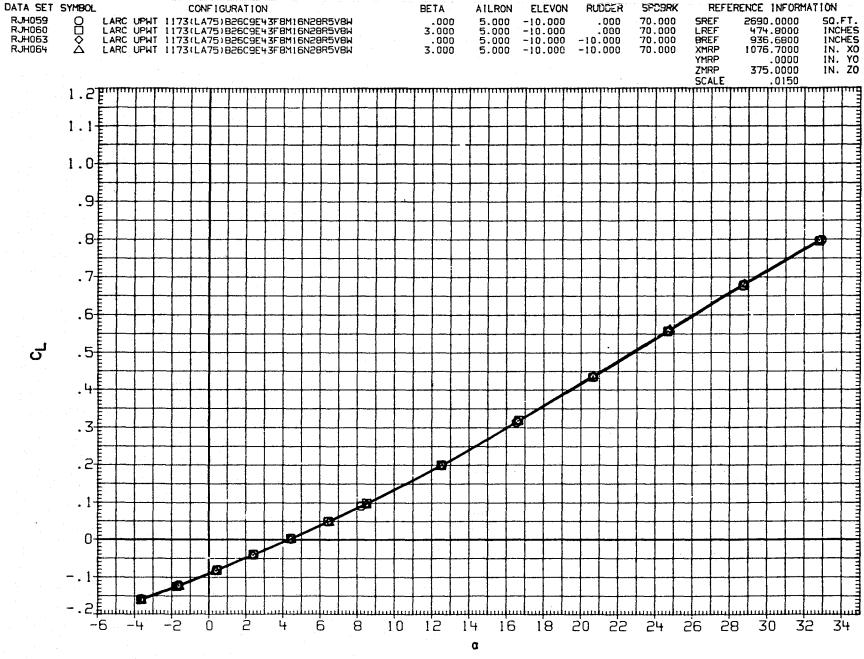
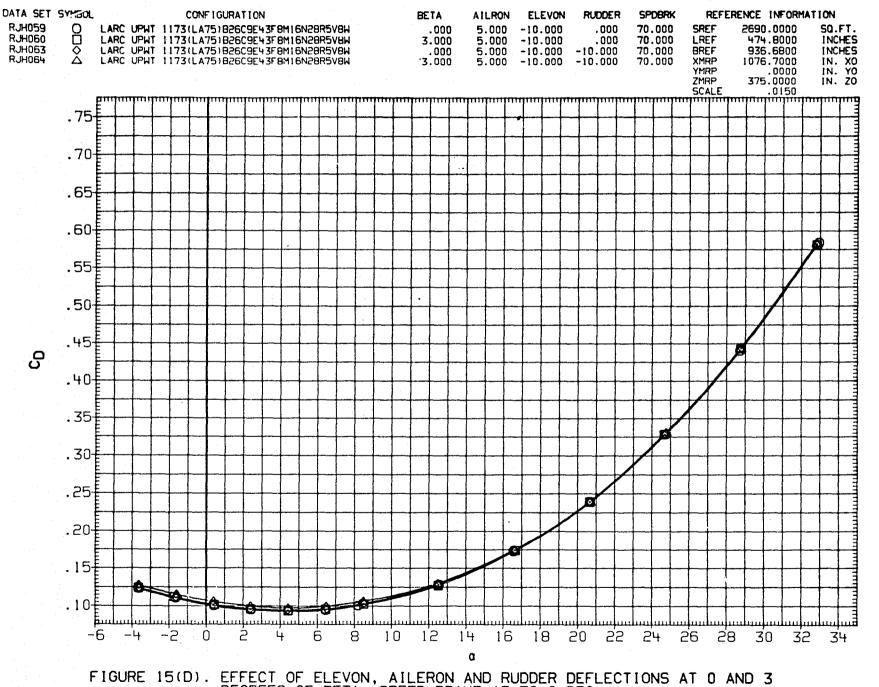


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(B) MACH = 3.90
PAGE 594

A. A.



DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(B) MACH = 3.90

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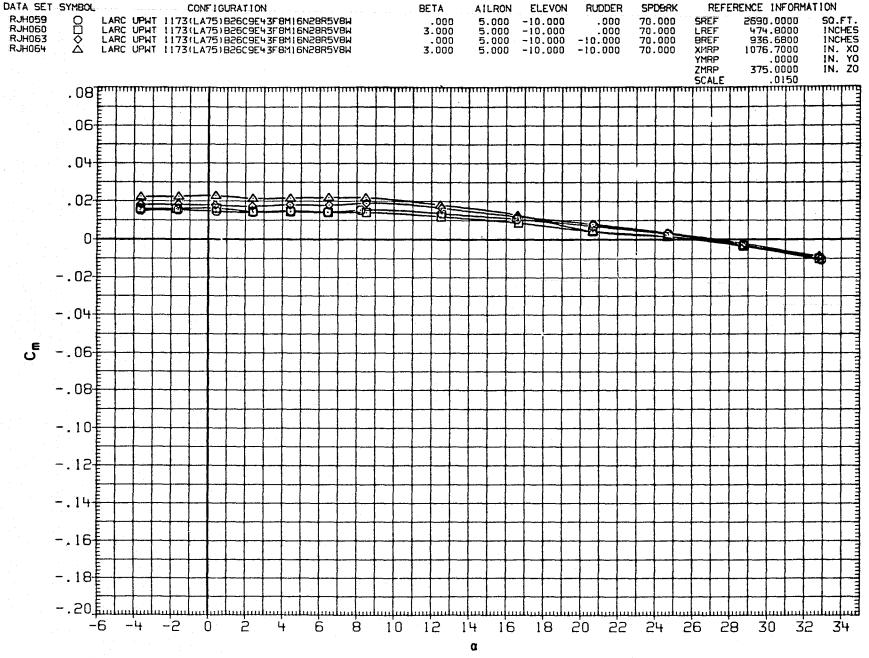
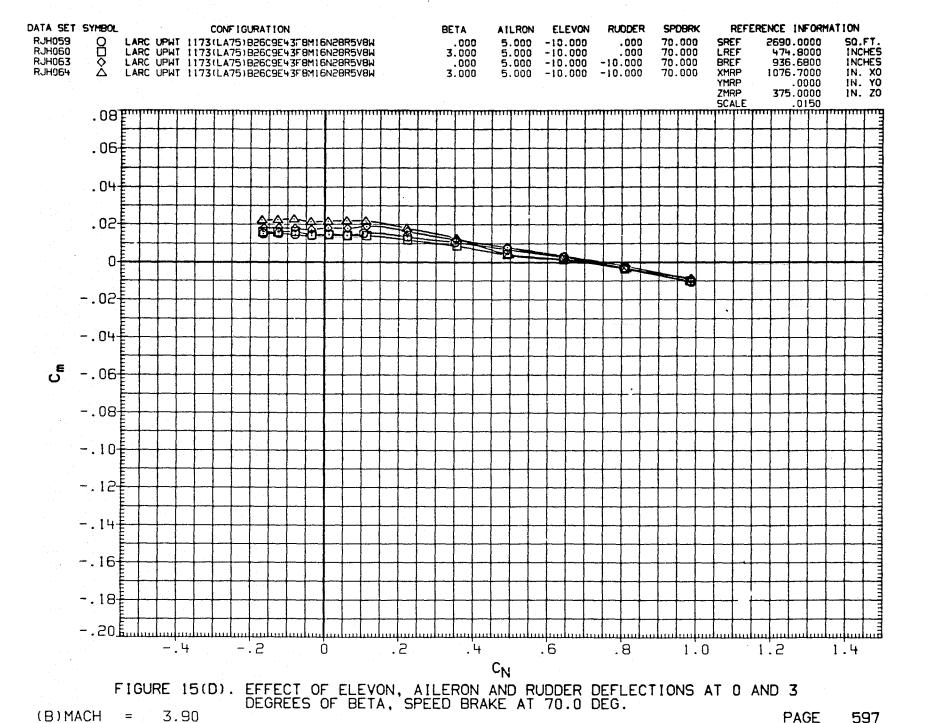


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

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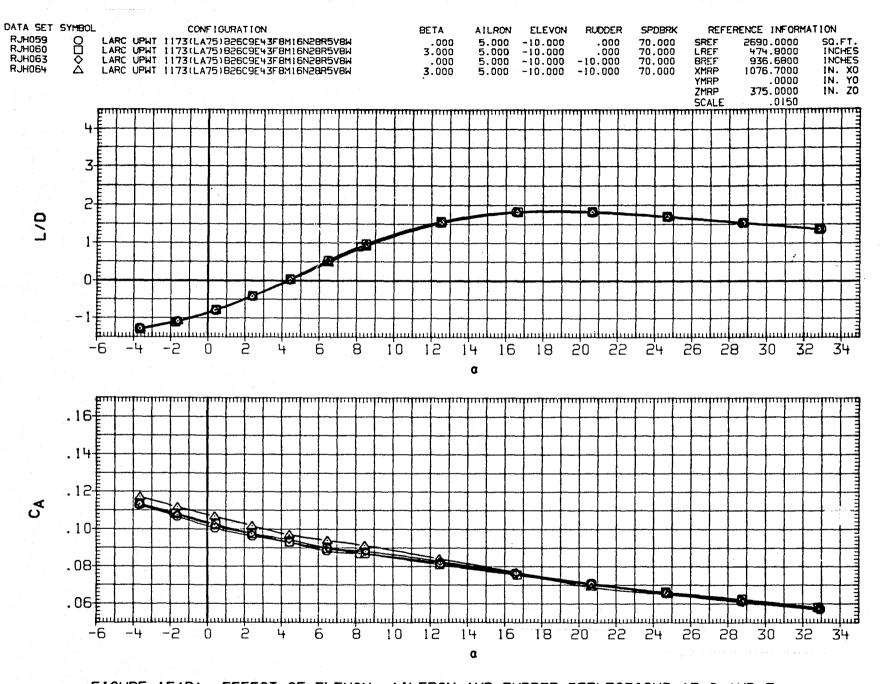


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(B) MACH = 3.90
PAGE 598



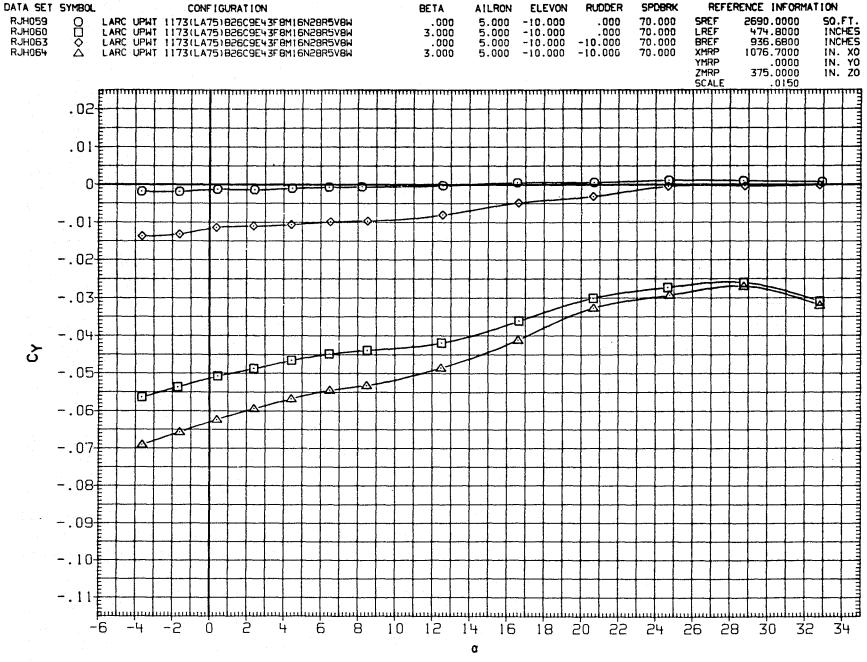


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(B) MACH = 3.90 PAGE

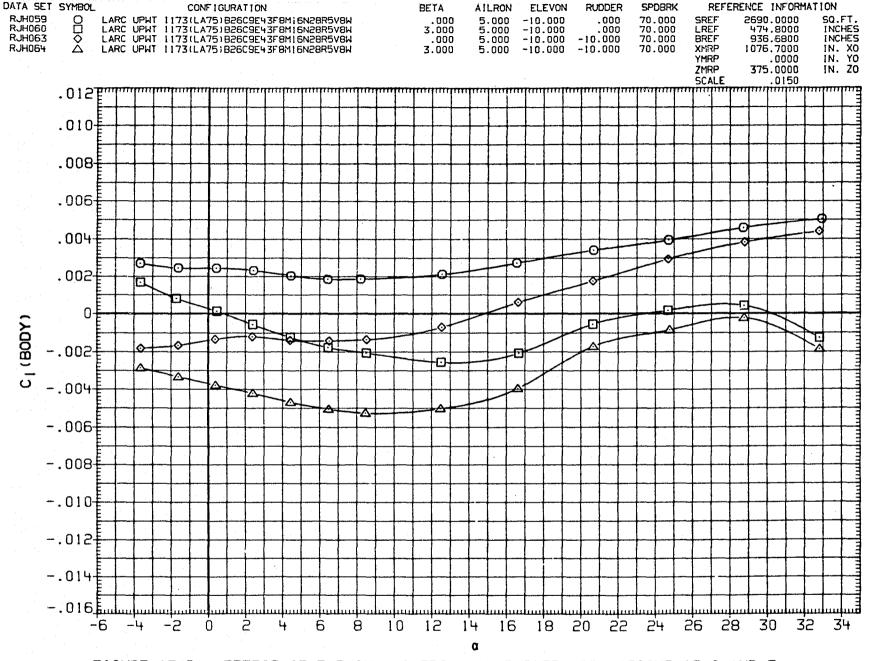


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 600

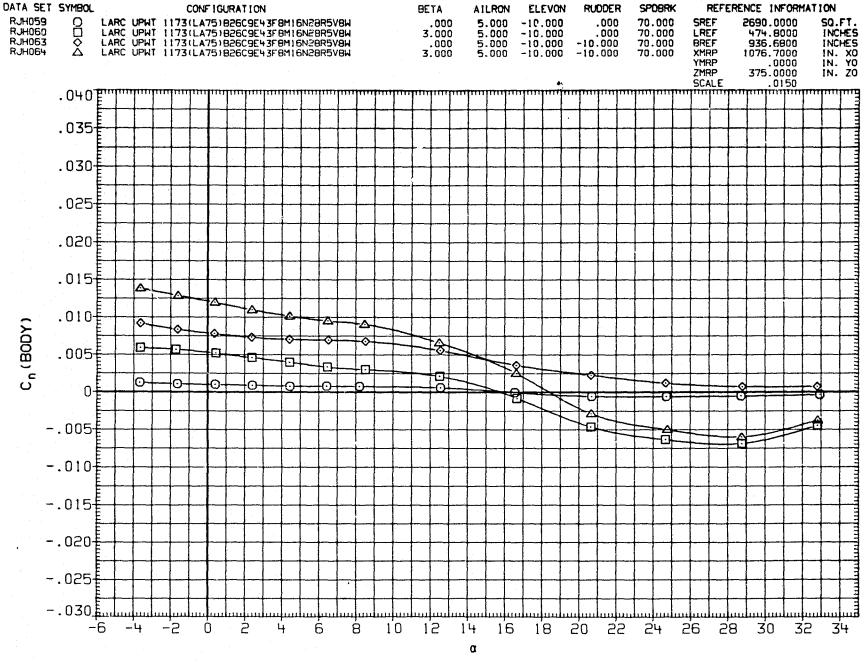
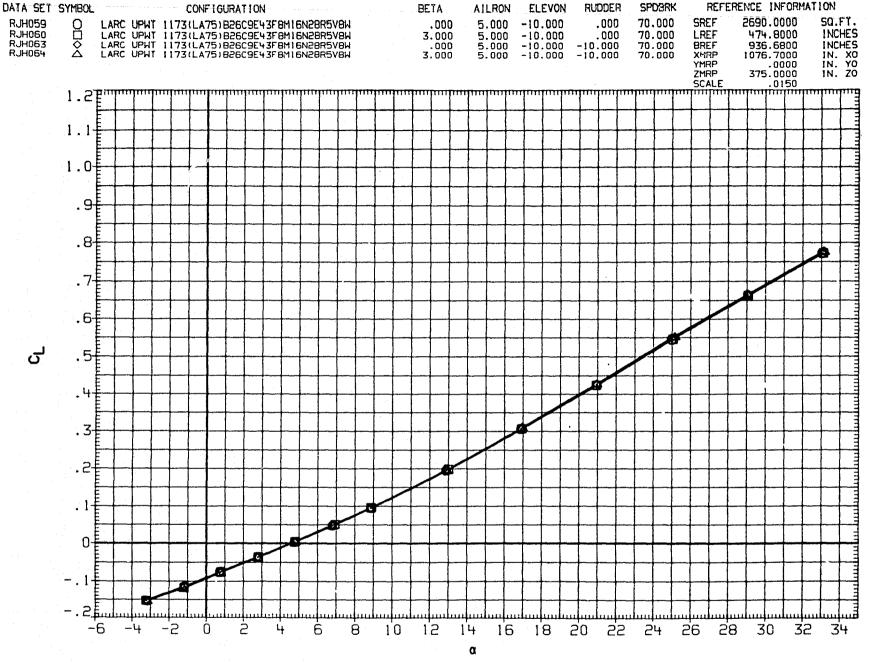


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG. PAGE

(B)MACH =3.90



REFERENCE INFORMATION

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FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG. (C)MACH =4.60 PAGE 605

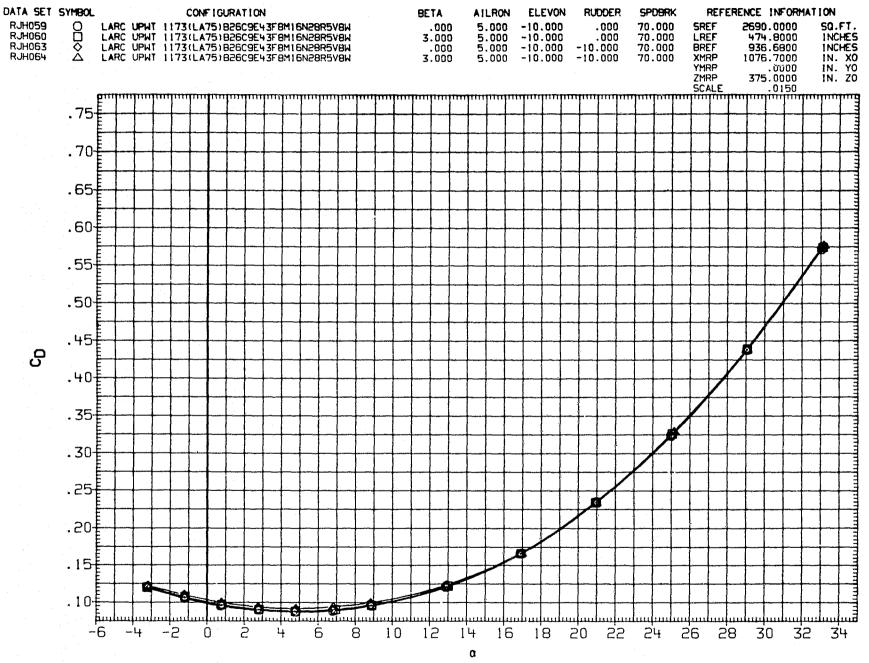


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(C)MACH = 4.60

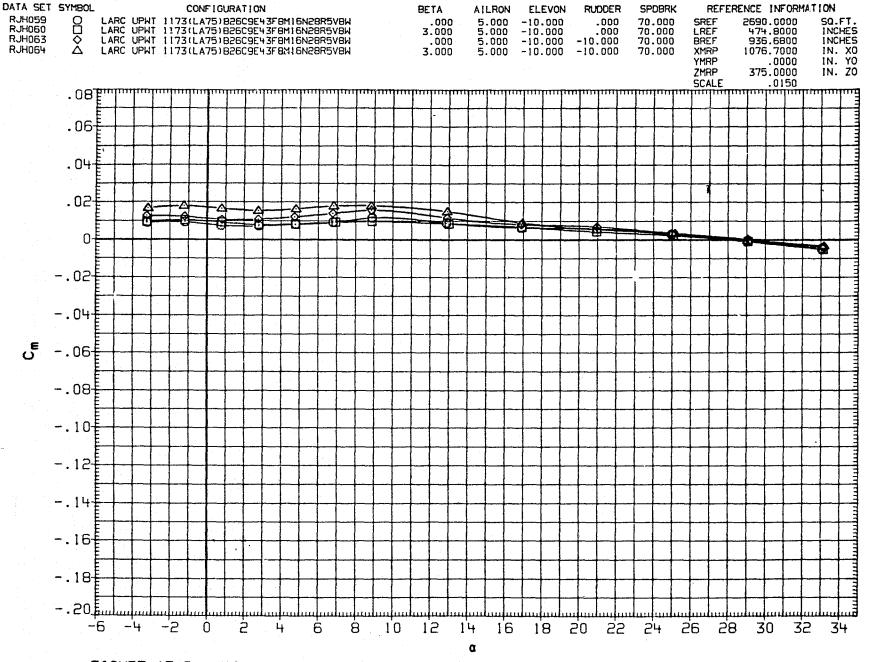


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 604

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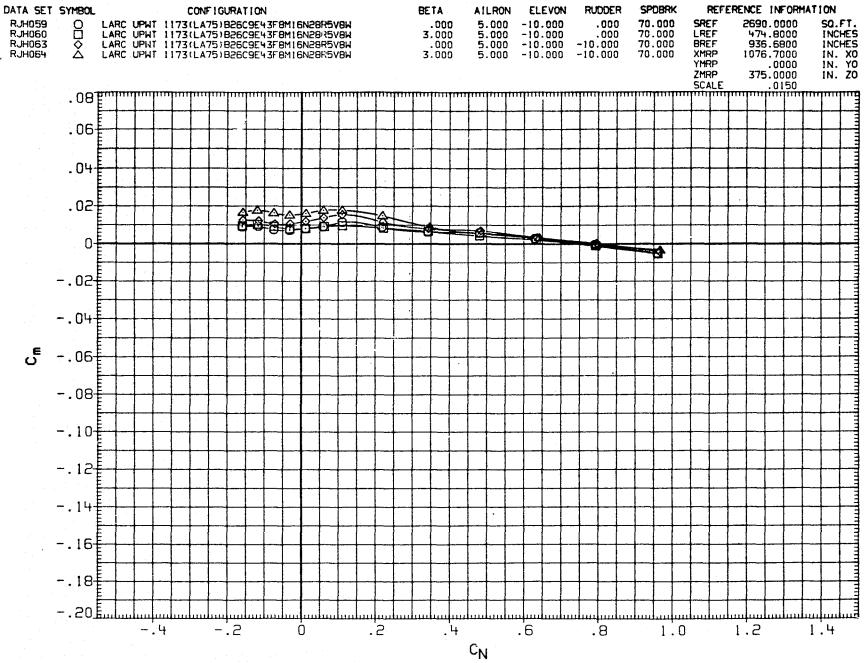


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 605

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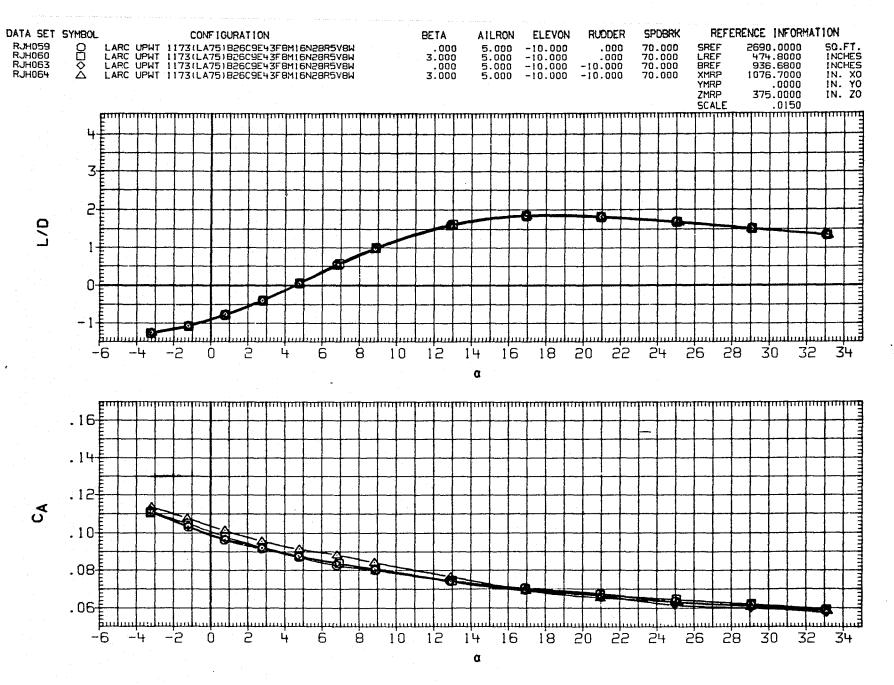
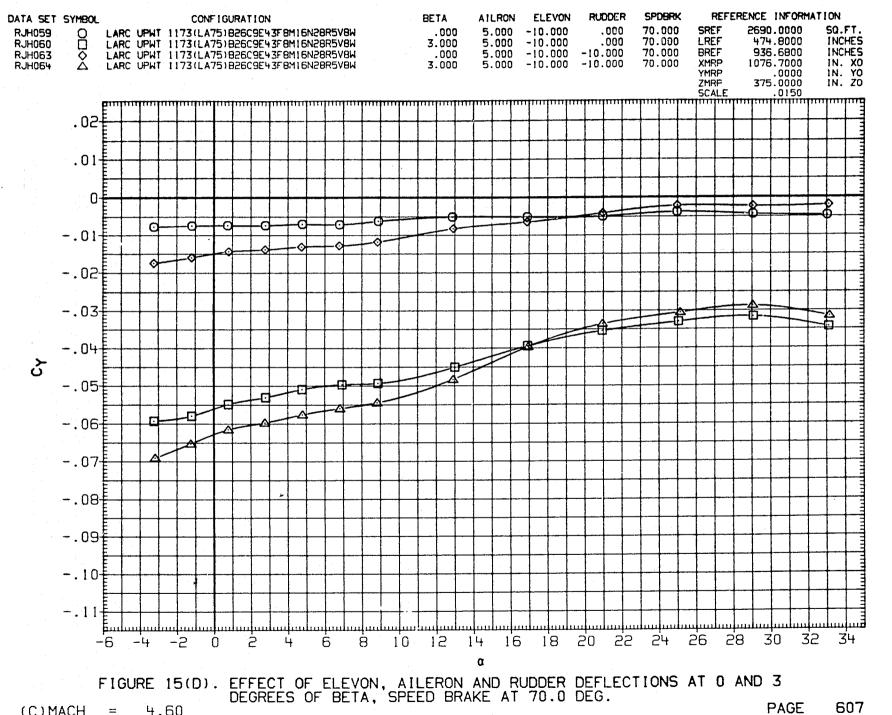


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(C) MACH = 4.60
PAGE 606

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(C) MACH

4.60

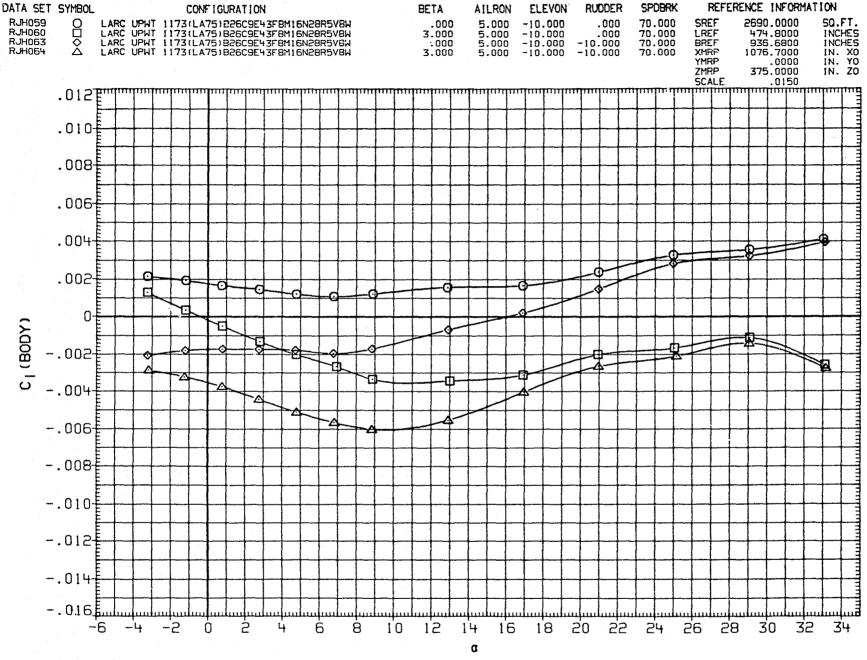


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
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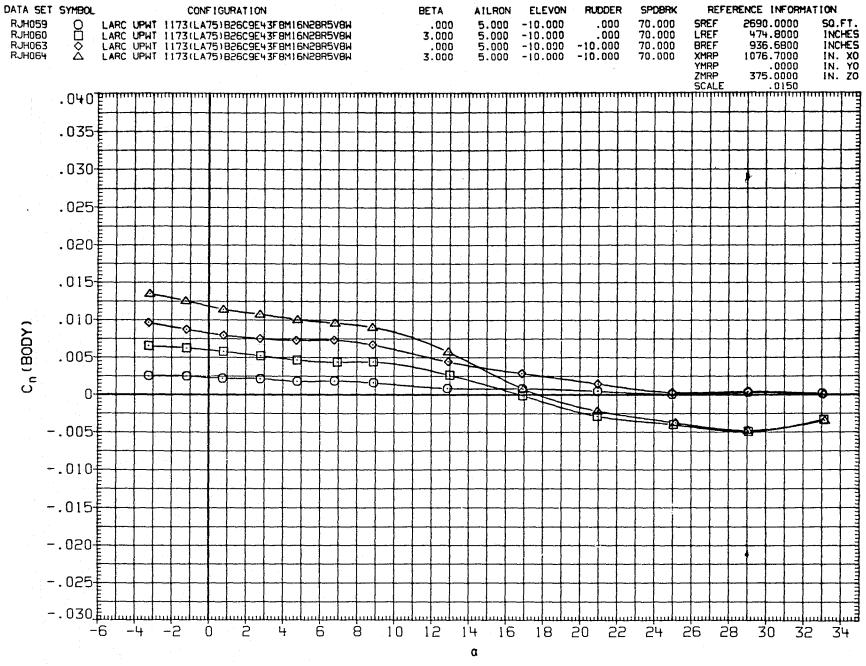


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

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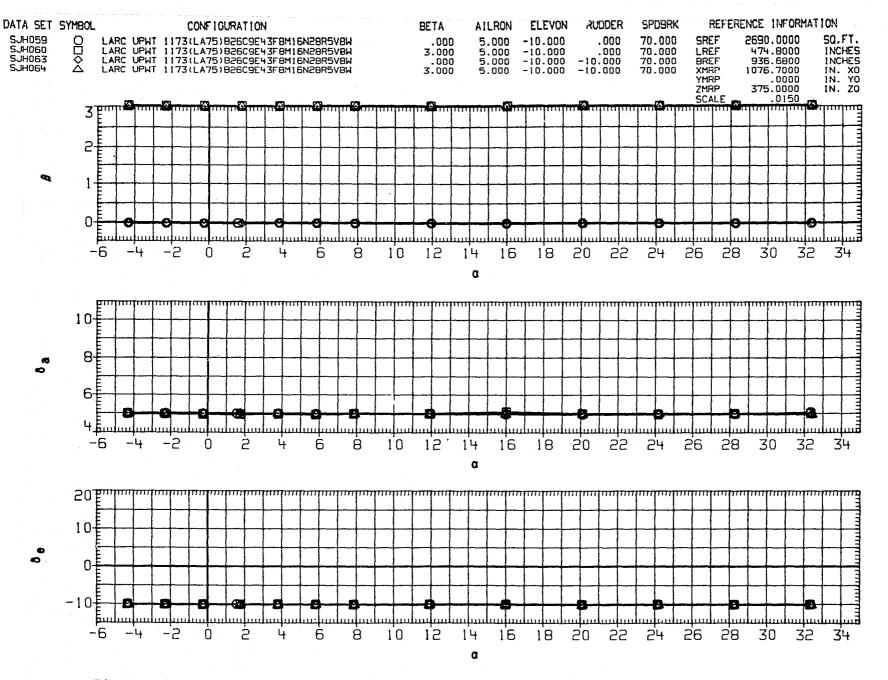


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 610

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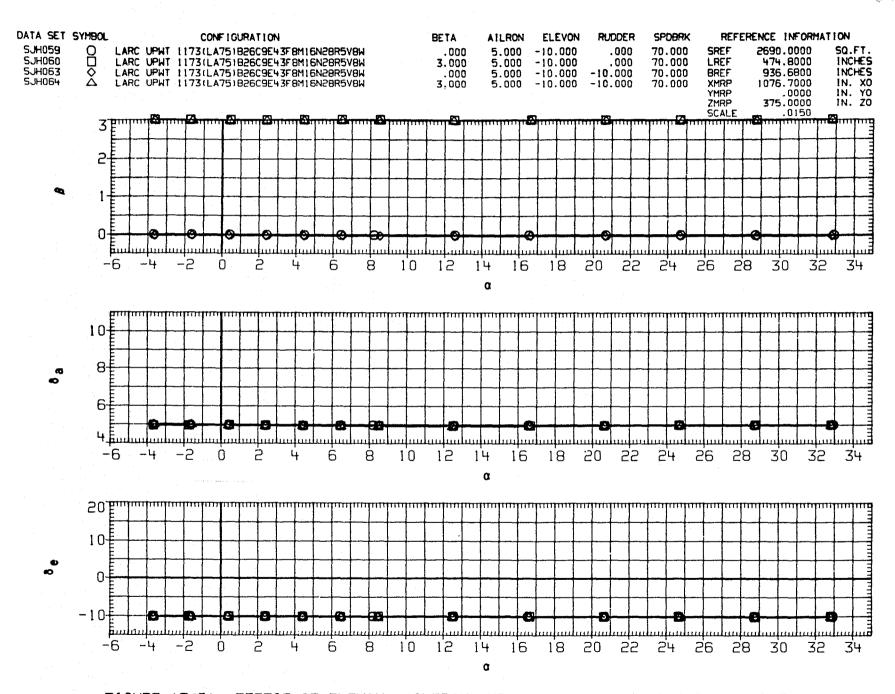


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.

(B) MACH = 3.90
PAGE 611

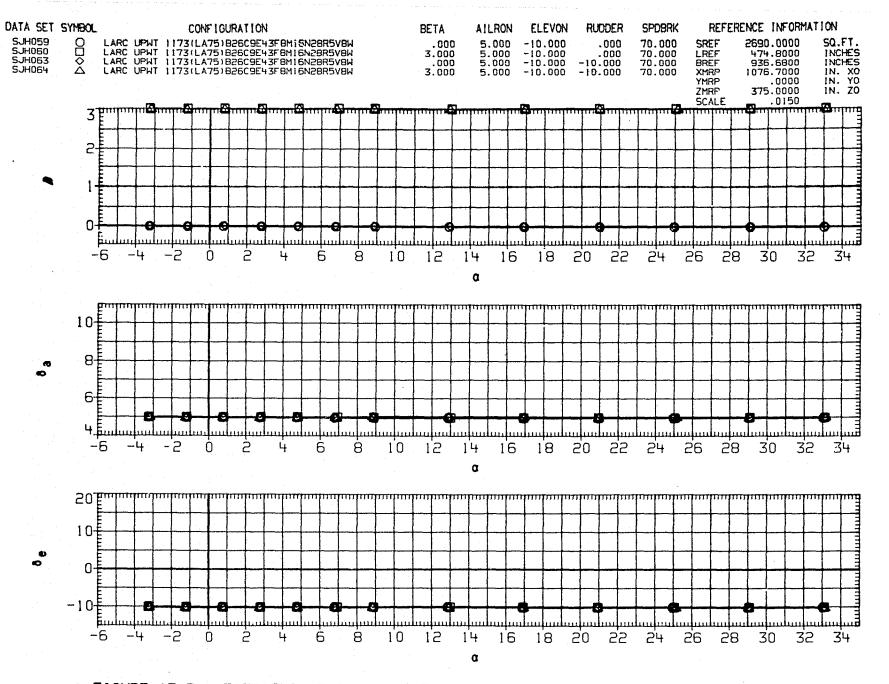


FIGURE 15(D). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 70.0 DEG.
PAGE 612



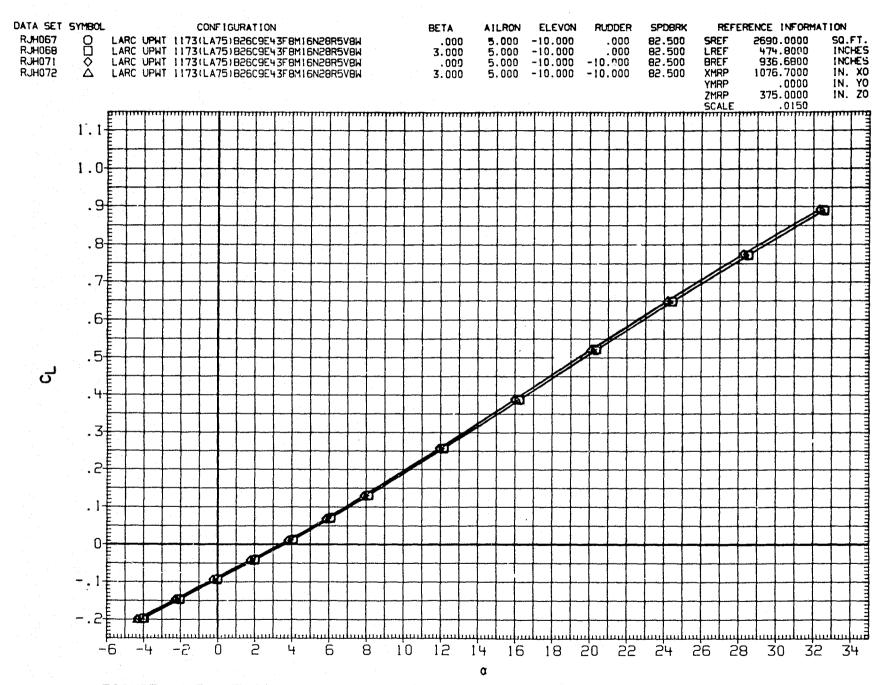


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(A)MACH =2.86

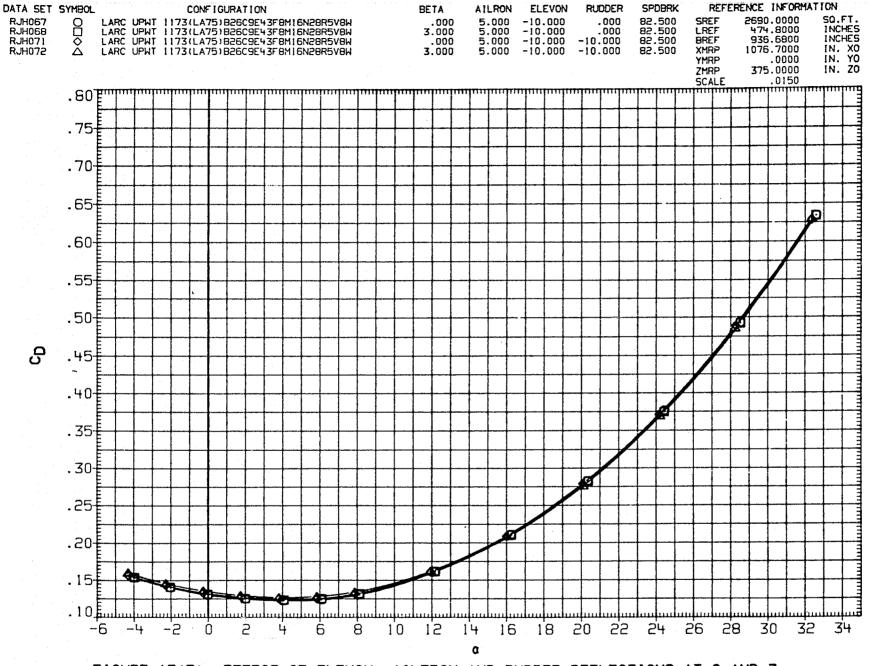


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 614

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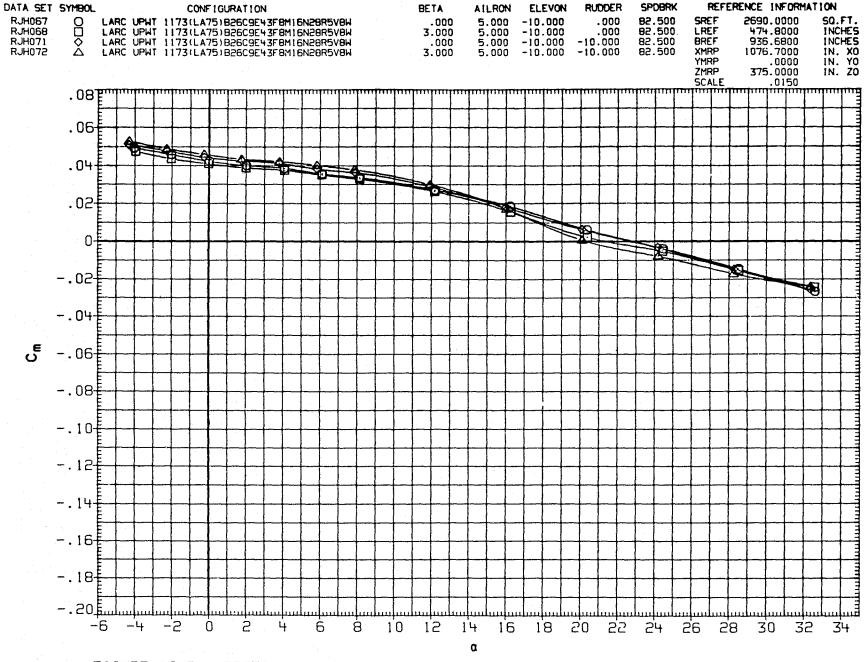


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(A)MACH = 2.86

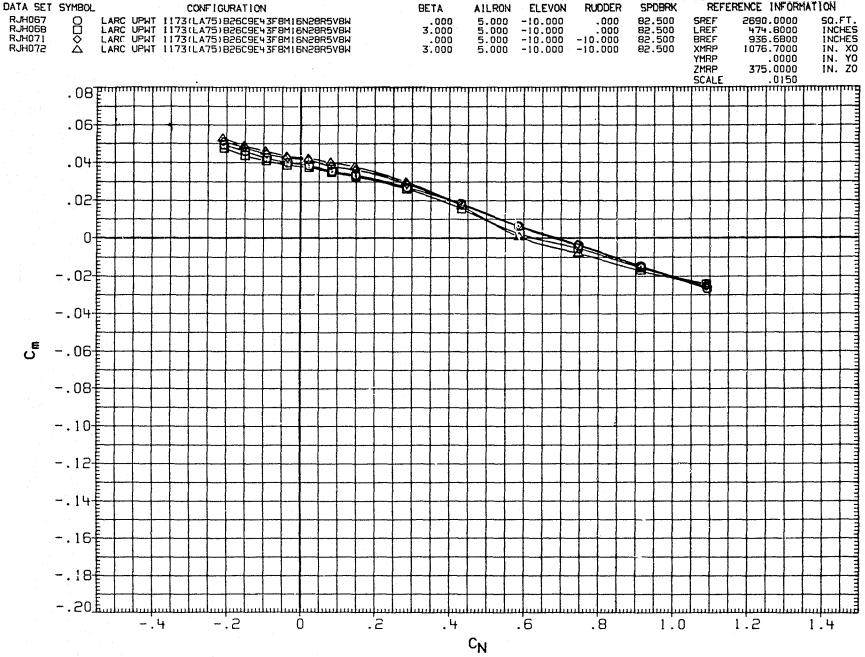


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 616

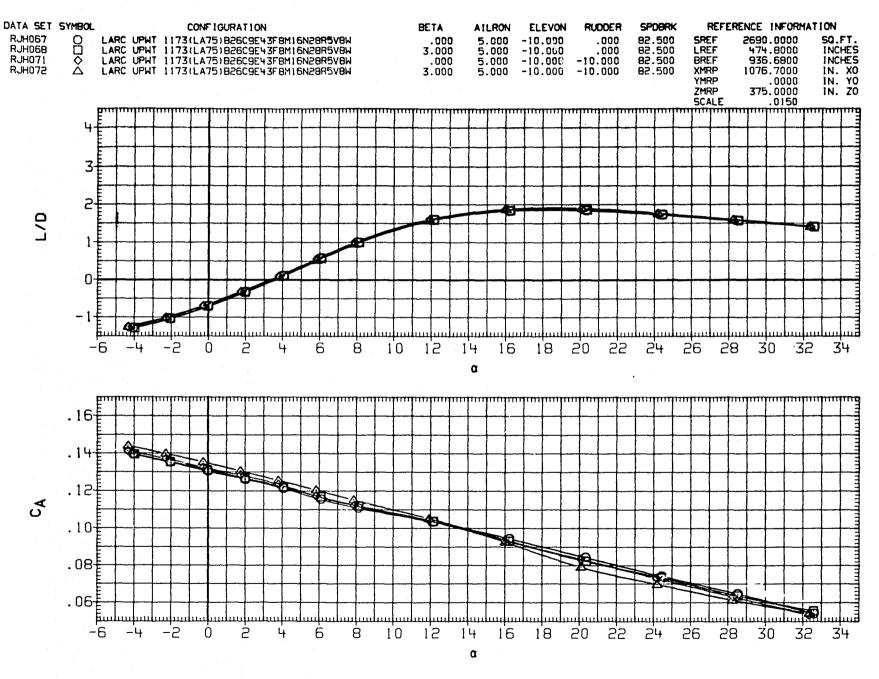


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
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(A) MACH = 2.86
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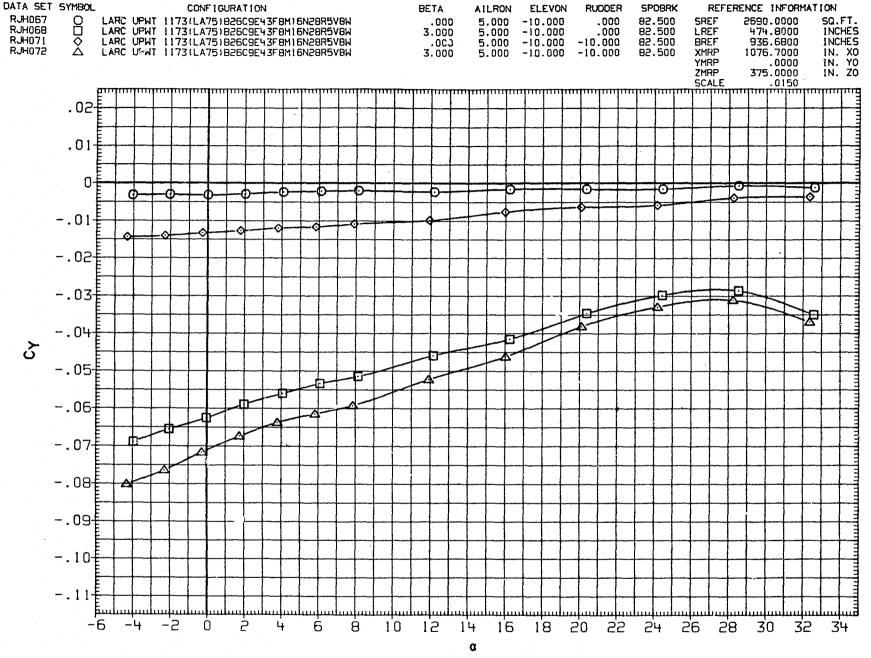


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 618

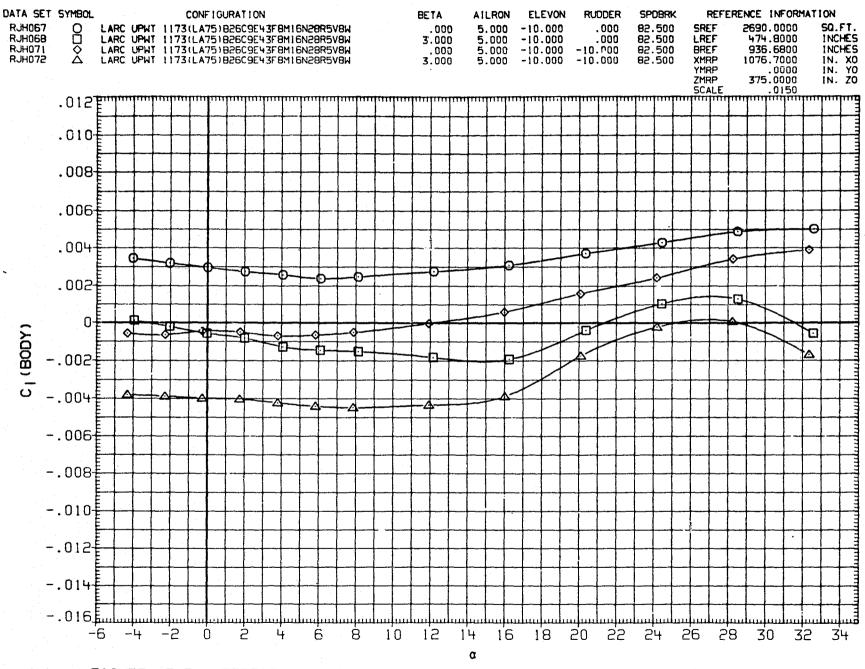


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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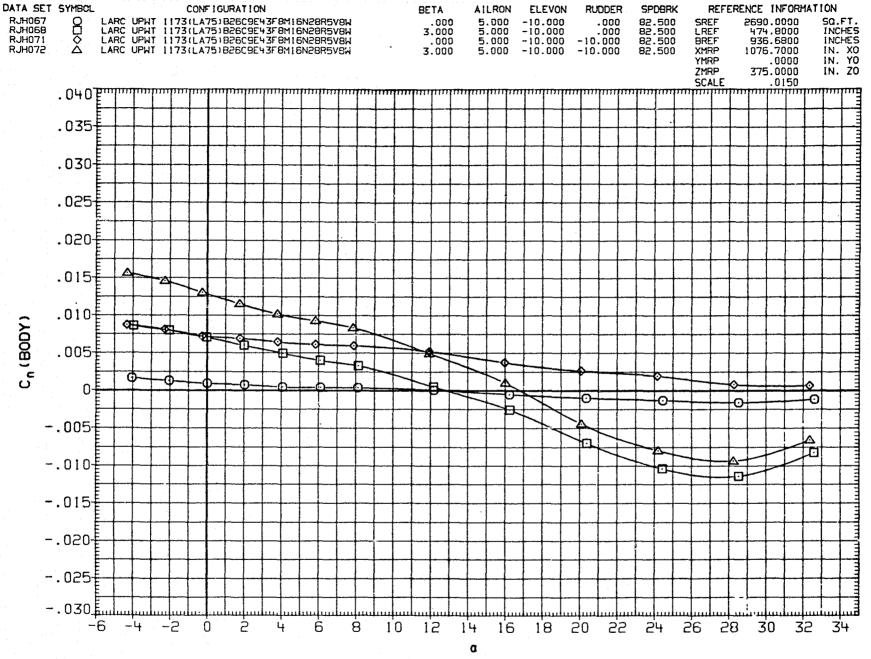


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 620

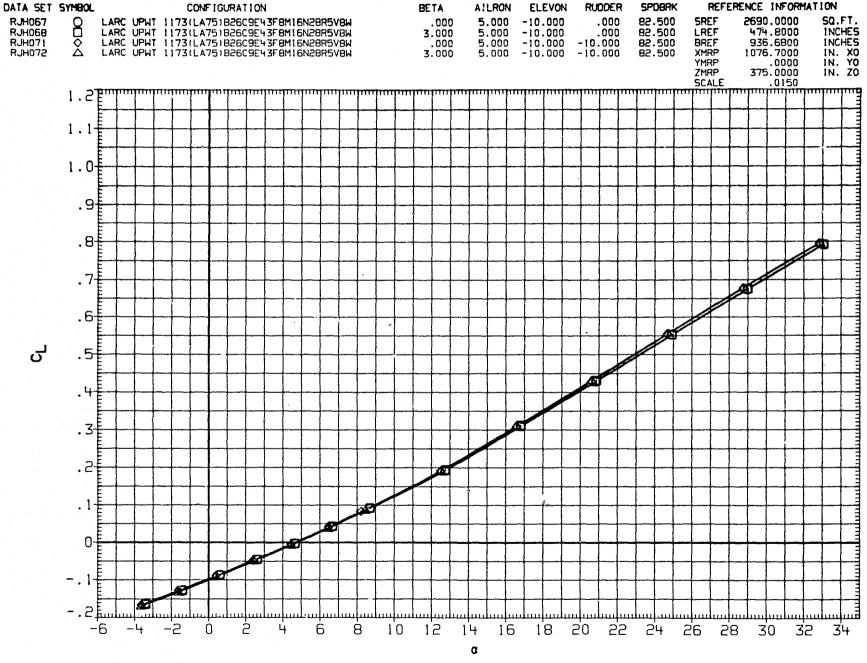


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
PAGE

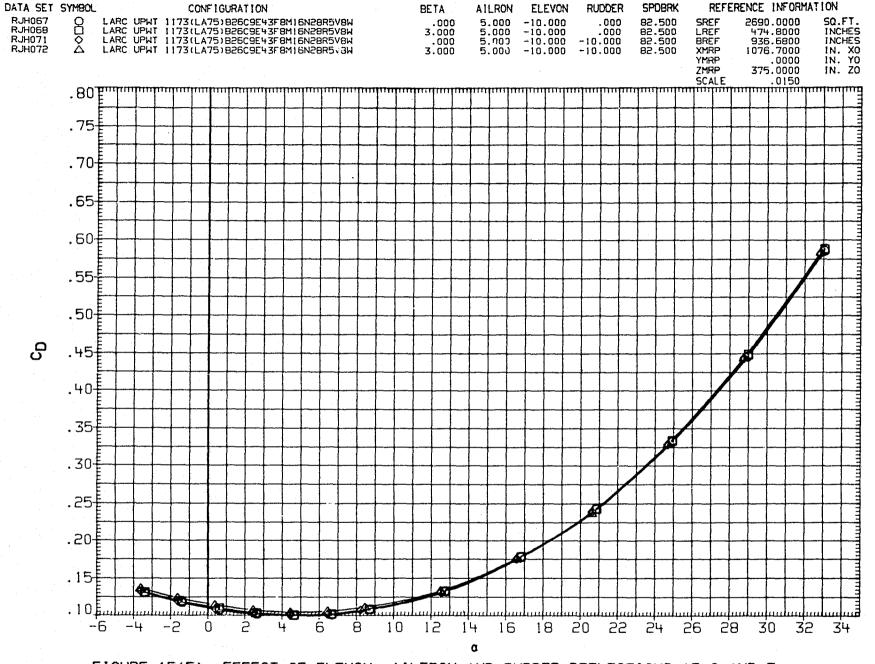


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 622

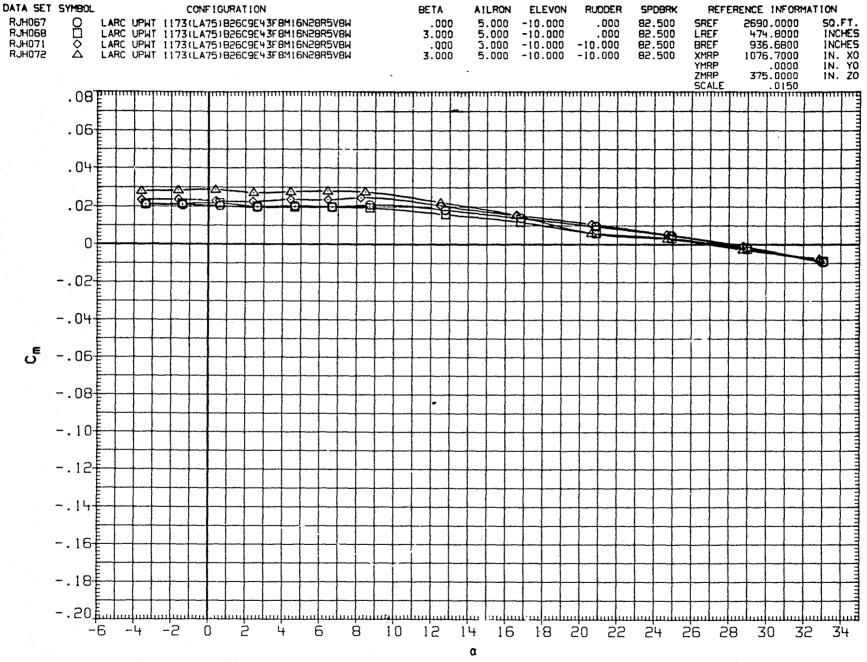


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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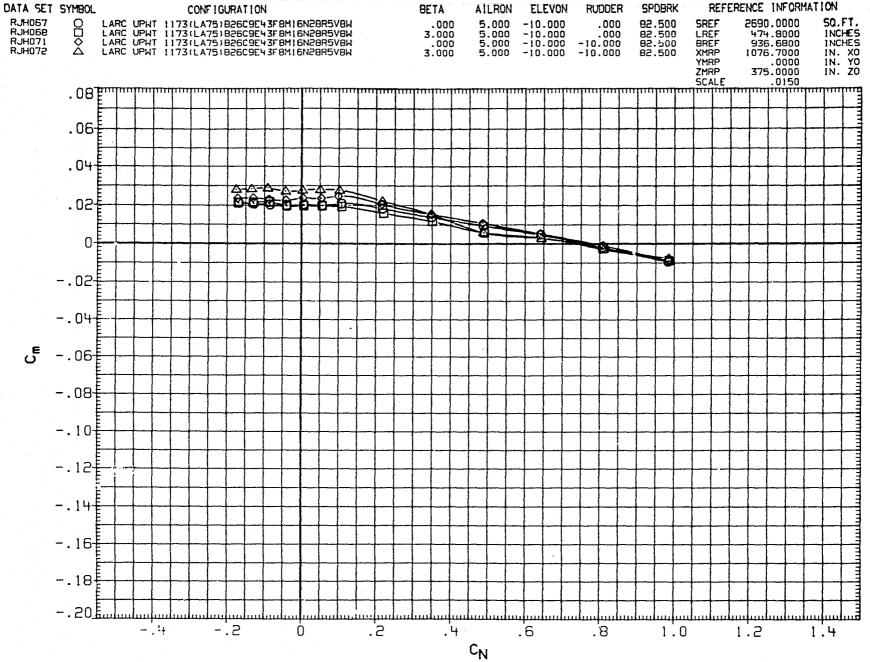


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

PAGE 624

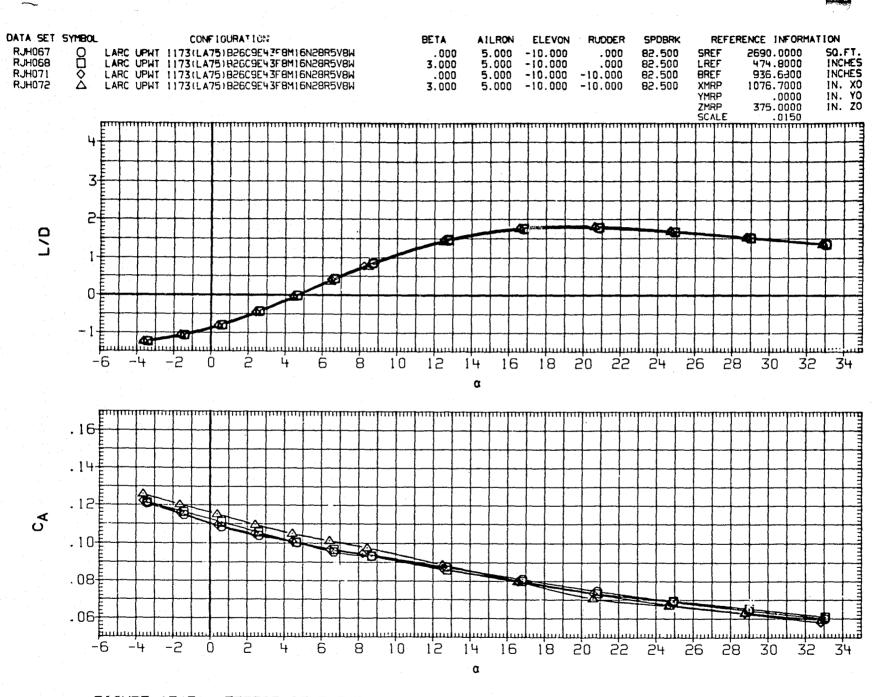


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 625

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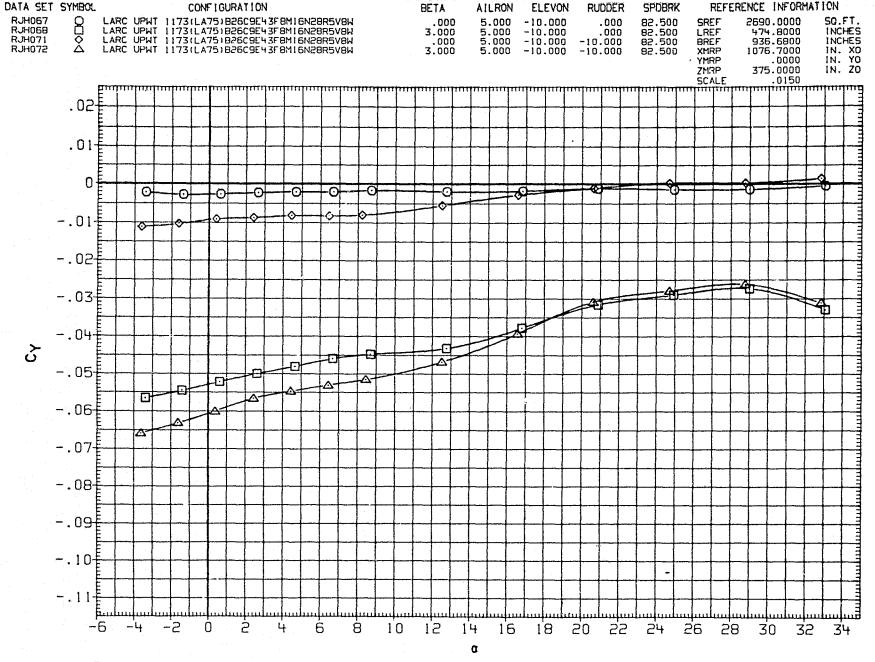


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 626

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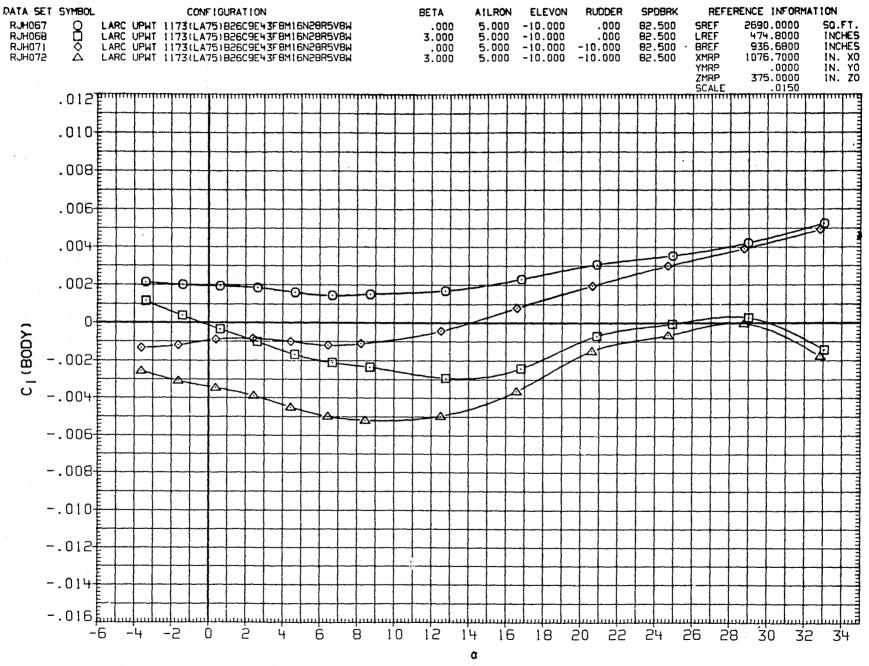


FIGURE 15(E). EFFECT OF ELEVON. AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(B) MACH 3.90

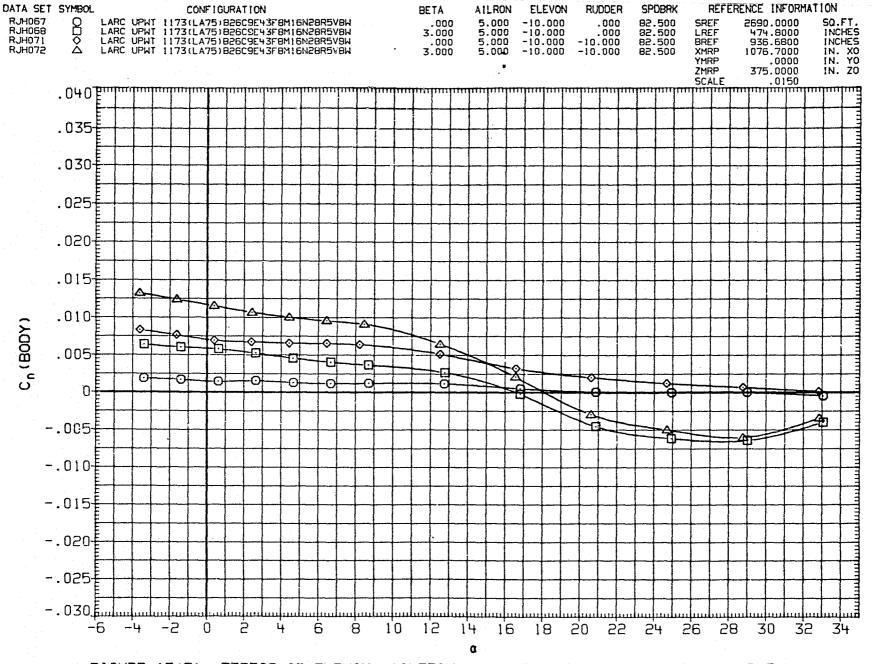


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(B) MACH = 3.90
PAGE 628

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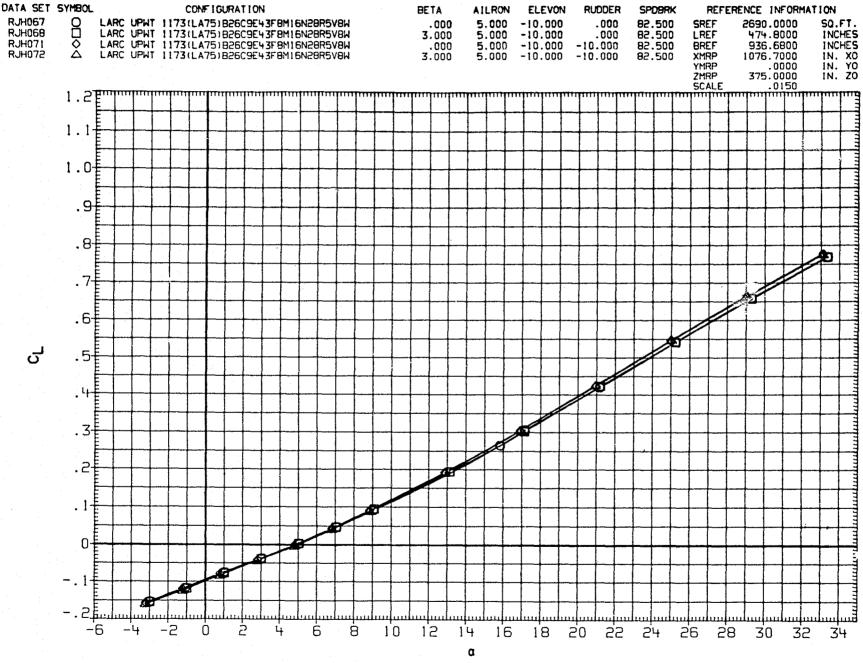
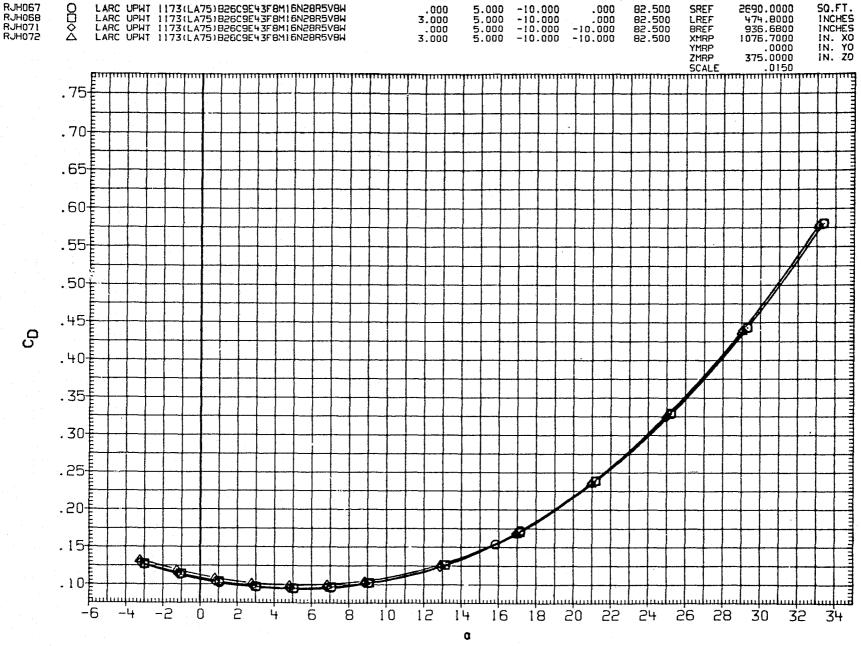


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(C) MACH = 4.60



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REFERENCE INFORMATION

DATA SET SYMBOL

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FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 630

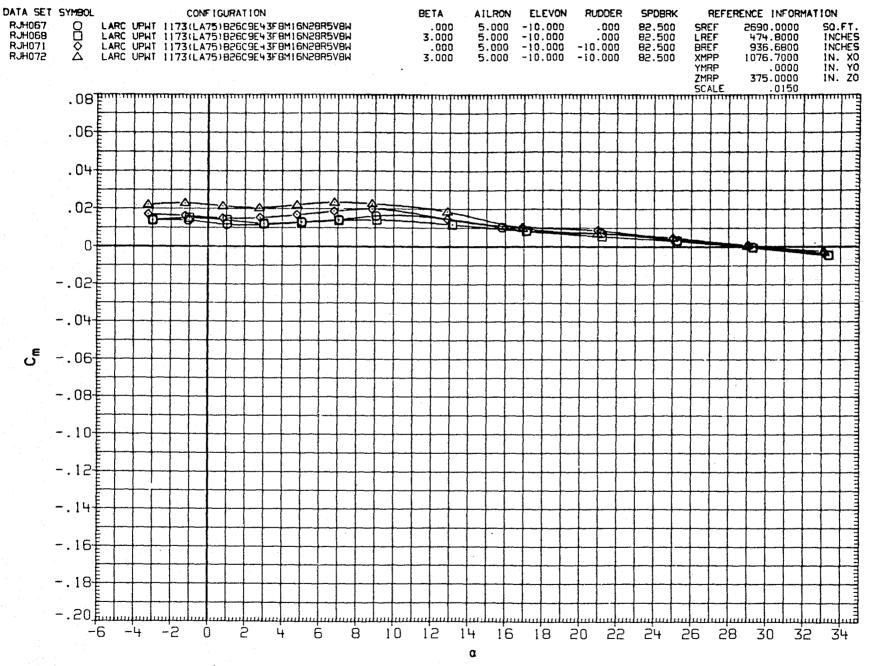


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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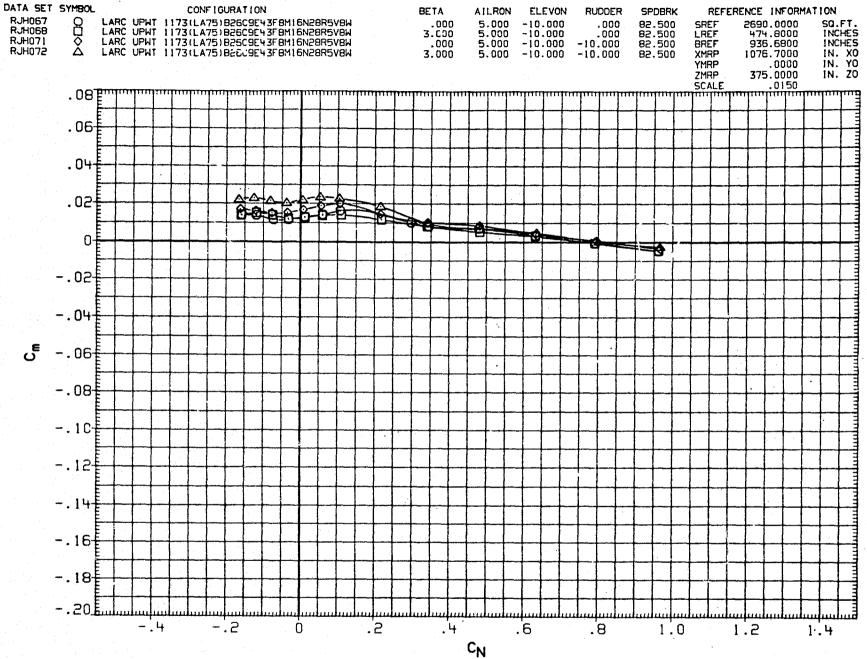


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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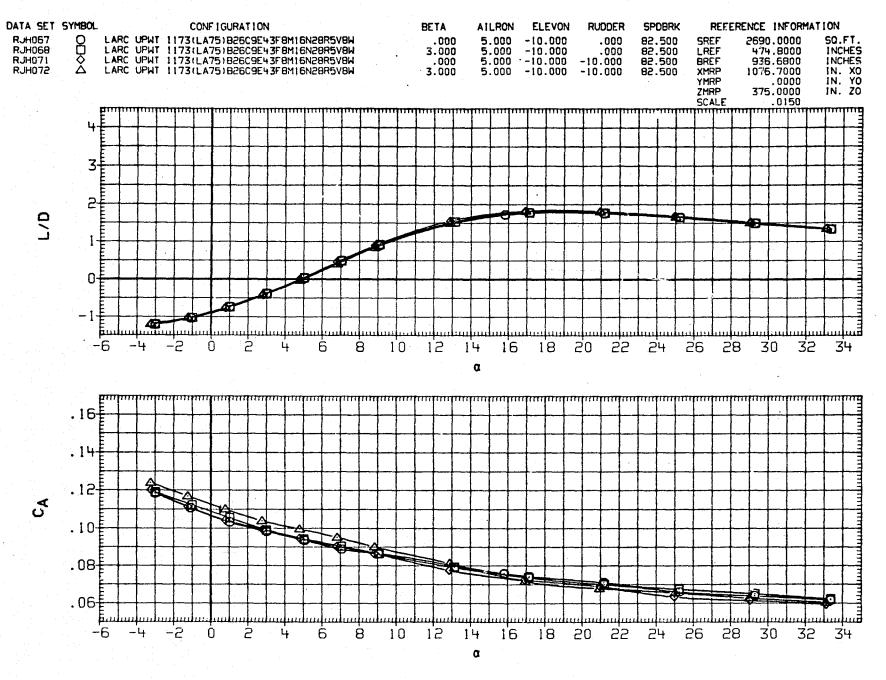


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG. PAGE

(C)MACH =4.60

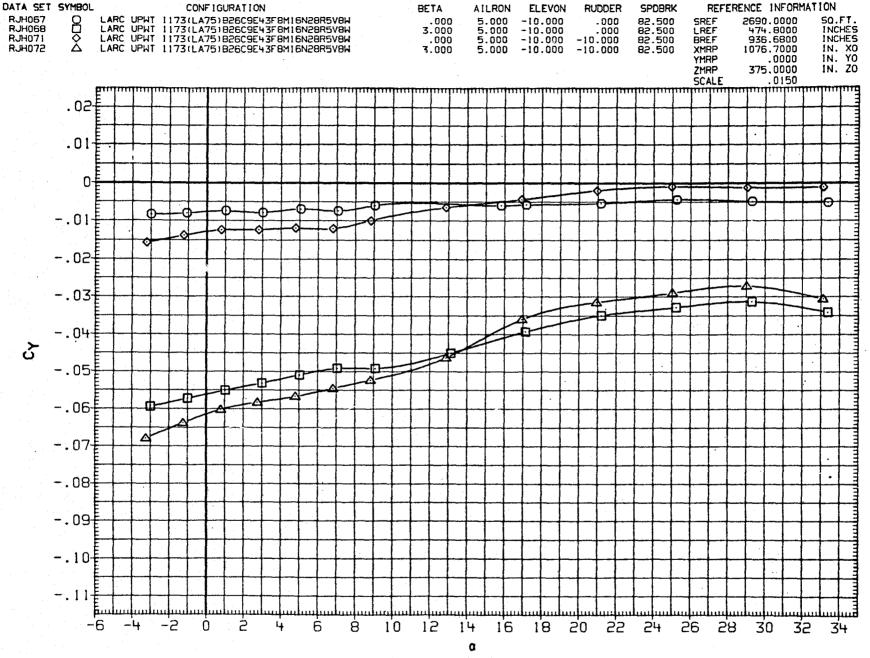


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 634

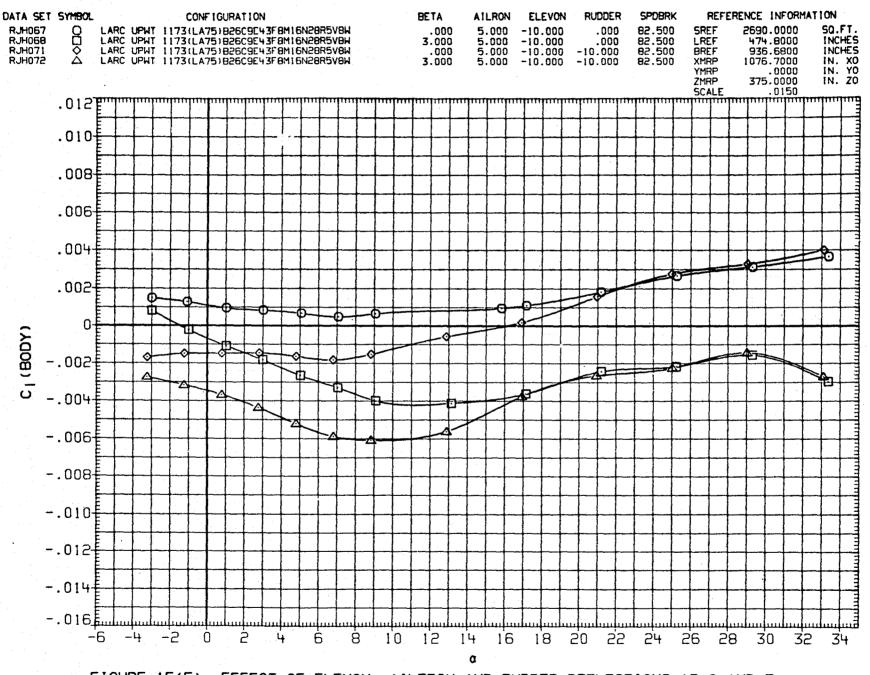


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
PAGE 635

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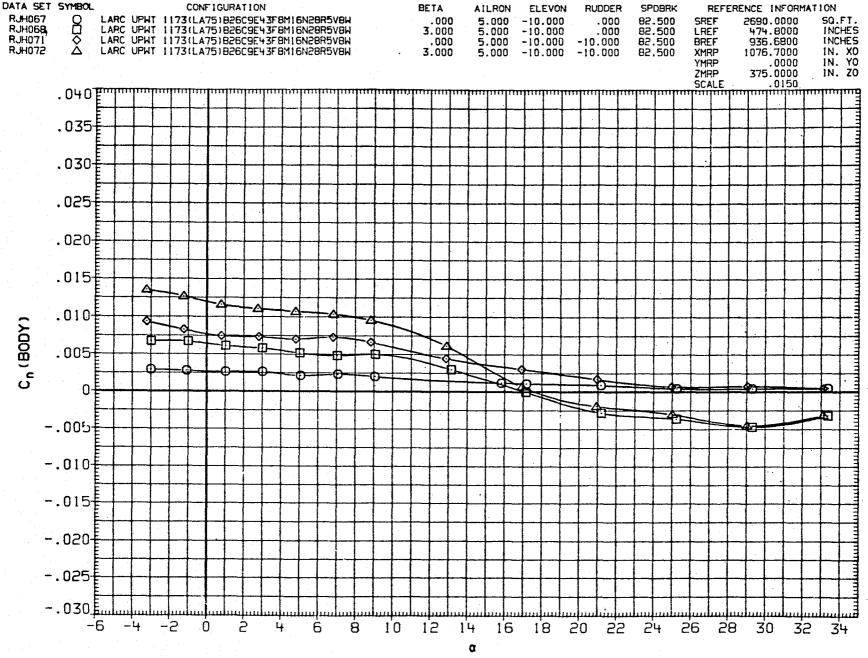


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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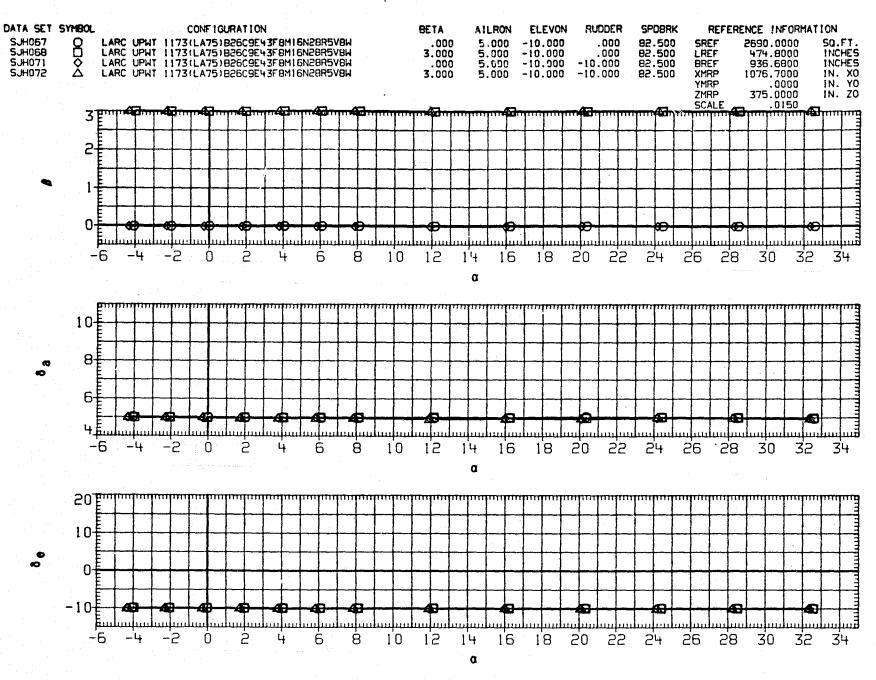


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3 DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.

(A) MACH 2.86

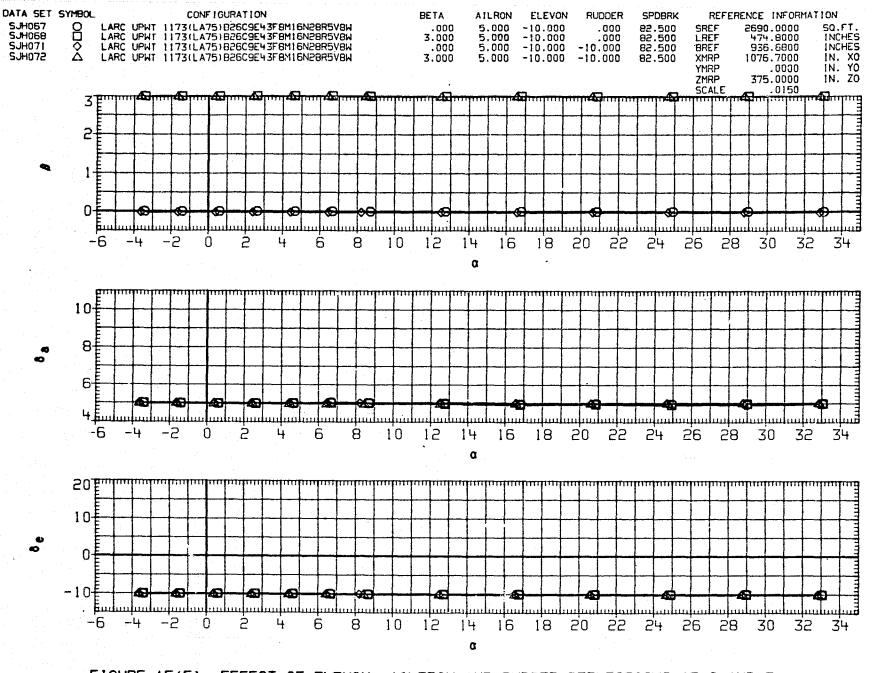


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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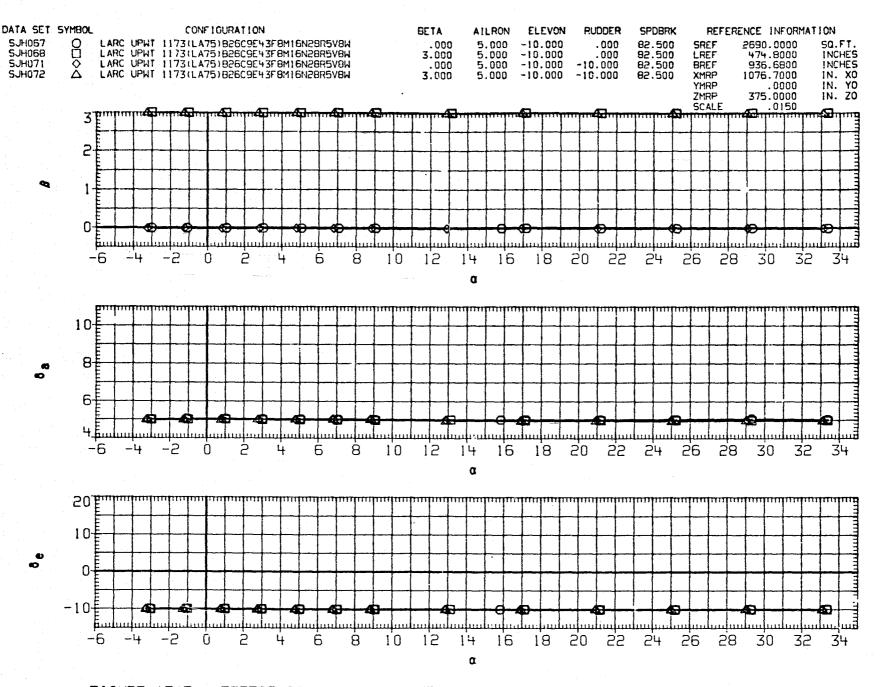


FIGURE 15(E). EFFECT OF ELEVON, AILERON AND RUDDER DEFLECTIONS AT 0 AND 3
DEGREES OF BETA, SPEED BRAKE AT 82.5 DEG.
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